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ERRATA.

P. 715, bottom line, *for* "Parkfield" *read* "Pakefield."

P. 716, 22nd line from top, *for* "was probably identical with" *read* "was probably not identical with."

BRITISH MUSEUM 25 AP 1900

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

January 17, 1899.

Dr. Albert Günther, F.R.S., V.P., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of December 1898:—

The total number of registered additions to the Society's Menagerie during the month of December was 80, of which 20 were by presentation, 1 by exchange, 19 by purchase, 35 were received on deposit, and 5 were born in the Menagerie. The total number of departures during the same period, by death and removals, was 97.

Dr. F. P. Moreno exhibited and made remarks upon the original specimen of the recently described mammal *Neomylodon listai*, which he believed to be a portion of the skin of one of the old Pampean Mylodons now quite extinct.

Mr. Sclater read some extracts from letters recently received from Mr. J. S. Budgett, F.Z.S., who had been sent by the Council on a scientific mission to the Gambia (see P. Z. S. 1898, p. 852).

Mr. Budgett had arrived at M'Carthy's Island, 127 miles up the river, on Nov. 11, and up to the date of his last letter (Dec. 8) had been principally occupied in collecting Fishes. He had obtained a large number of *Polypteri* of different sizes, the

largest being about 19 inches in length. The ovaries of the females did not appear to be nearly ripe, and, according to native reports, these fishes did not spawn until the wet season. Only two of the whole number possessed external gills. Altogether, examples of about twelve species had been procured, amongst which were two of *Mormyrus*, a *Malapterurus*, several Siluroids, and a Sword-fish, 8 feet 6 inches in length.

Mud-fish (*Protopterus*) were stated by the natives to be abundant in the adjoining swamp, but Mr. Budgett had not yet succeeded in obtaining specimens.

Mr. Budgett was also collecting Birds and Insects (principally Orthoptera and Hemiptera).

Mr. A. H. Cocks, F.Z.S., exhibited some living specimens of supposed hybrids between the Stoat (*Mustela erminea*) and the Ferret (*M. furo*), and remarked that it was only on seeing the first of his specimens that his scepticism as to the possibility of such hybridity had been removed. Early in 1898 he had seen an advertisement respecting some half-bred Stoats and Ferrets, and had purchased three of them; and was so satisfied as to their genuineness, that he subsequently purchased the remainder of the breeder's stock, making six specimens in all. One female died from foot-rot; the second became pregnant to a Polecat, but miscarried almost at the last moment; the third (exhibited) was at the date of purchase said to be a week gone in young to a male hybrid purchased at the same time, and in due course produced a fine litter of 4 males and 1 female (one of the males was also exhibited). The breeder (a railway signalman) had made most positive and straightforward statements as to the animals being the undoubted offspring of a male Stoat and female Ferret (both white and dark), and Mr. Cocks had taken an opportunity to interview him personally; he stated that he had bred altogether some six litters between Stoats and Ferrets, and considered such cross, if anything, easier to breed than pure Ferrets. At the time of Mr. Cocks's visit, a young Weasel was sharing a hutch with a pair of Ferrets.

The specimens, including the second generation, were exactly alike, except the father of the second generation, which was somewhat paler but with identical markings, and was probably born from a white Ferret. Ferrets of course varied very greatly in the body-colour, but Mr. Cocks had never seen any Ferrets with exactly the body-colour or texture of pelage as these, and this improvement on the ordinary quality of a Ferret's pelt was seen in Polecat and Ferret crosses. The following points also showed a resemblance to Stoats:—bright yellow throats; a small spot of yellow on the (true) knee; the distal portions of the feet were white, the colour terminating abruptly; the ears were broader than a Ferret's, and much more so than a Polecat's; the moustachial bristles were finer and more numerous than in a Polecat, but

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possiby this last point might not hold good in a large series of Ferrets. Of the British *Mustelidæ*, the Stoat had by far the biggest feet in proportion to its size; the Polecat had relatively very small feet, those of Ferrets being decidedly larger; while the feet of these hybrids were markedly larger than the normal size of those of Ferrets.

Mr. Cocks also exhibited the skull of the reputed hybrid which had died; together with, for comparison, a skull of a Stoat, of a Polecat, and of a Polecat-Ferret cross (*cf.* 'Zoologist,' 1880, p. 396).

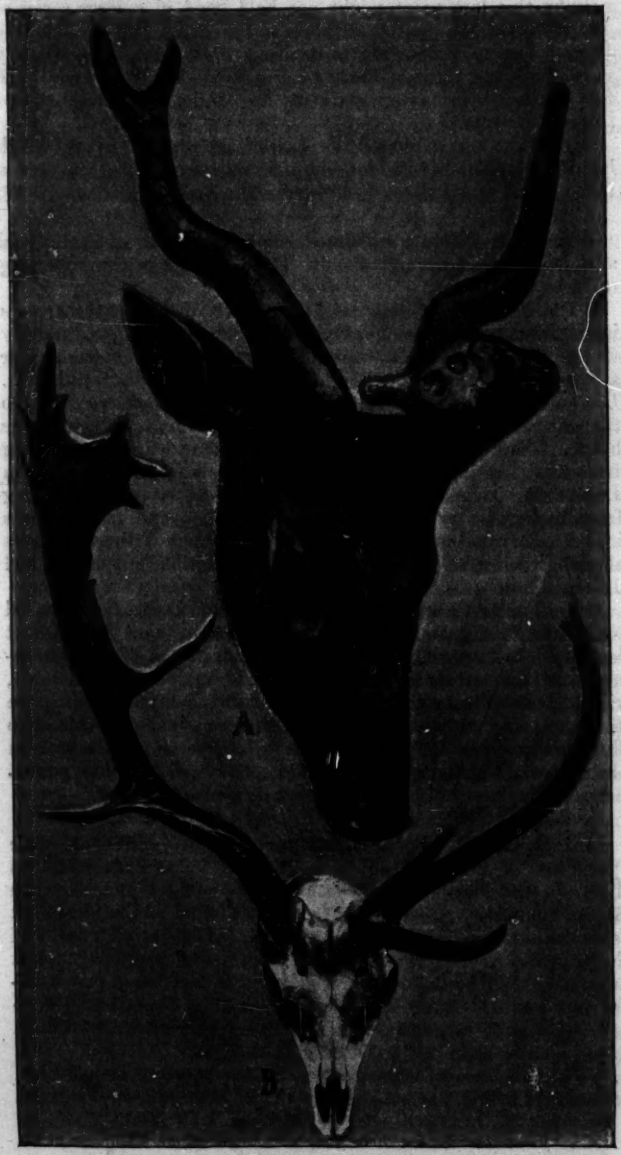
Mr. R. E. Holding exhibited some specimens of malformed antlers of the Axis and Fallow Deer, and made the following remarks upon them:—

"The Axis Deer (*Cervus axis*) (fig. A, p. 4) lived over three years in the Manchester Zoological Gardens, and on its death the body was kindly sent to me by the proprietors, Messrs. Jennison. For a considerable portion of this time it had seemed to be in ill-health. The horns were never shed during that time. About two years ago the soft tumour-like excrescences began to form at the base of the horns. I saw it early last year, and it was then apparently suffering from some wasting disease, probably tuberculosis. It died early in December. There was unfortunately no *post-mortem*; but judging from numerous notes and specimens collected, and from records in veterinary pathology, I think the specimen is interesting as showing the intimate association between continued ill-health and defective horn-growth.

"The Fallow Buck (*Cervus dama*) (fig. B, p. 4) was five years old when shot in August last and was in good condition. Throughout last year it had grown a perfectly normal pair of horns. The abnormality of the left horn is apparently due to a purely local cause, viz., imperfect formation of the "burr" directly after shedding the horns, causing the temporal artery, which supplies the blood to the horn when at the velvety stage, to course through a hole in the centre of the burr, and so dividing the beam up into points. Some indication of disease at the pedicle is also apparent."

Mr. G. E. H. Barrett-Hamilton, F.Z.S., exhibited some specimens of European Squirrels, *Sciurus vulgaris* Linnæus, to illustrate the local colour-variations. He pointed out that the British Squirrel was as different from those found on the Continent as any animal could well be, being distinguishable at all seasons of the year and not intergrading with Continental specimens. Yet naturalists had been slow to recognize this fact; and the extraordinary seasonal changes in the coat of the animal (unparalleled, he believed, among mammals) had never been systematically studied until taken in hand by Mr. Oldfield Thomas (see 'Zoologist,' 1896, p. 401). The correct name for the British Squirrel (as had been pointed out by Mr. Thomas) appeared to be *Sciurus leucurus*[1] Kerr.

[1] Spelt *leucourus* by Kerr (*cf.* 'Animal Kingdom,' p. 256, 1792).



A. Malformed antlers of Axis Deer. B. Ditto of Fallow Deer.

It differed from the Continental Squirrel of all localities in the fact that the tail was never red (except occasionally in a few quite young specimens, and then never so bright as in Continental specimens), but brown, and that it bleached regularly each season to a dirty cream or straw-colour.

On the Continent of Europe the Squirrels of all localities were greatly affected with total or partial melanism, which made them rather a difficult subject for study. Excluding the melanisms, which had from time to time received names,—such as *S. niger* Kerr 1792, from Lake Baikal, *S. alpinus* F. Cuvier 1821, from the Pyrenees, and *S. italicus* Bp. 1838, from Italy,—Mr. Barrett-Hamilton stated that he knew of three subspecies of Squirrel in Northern and Central Europe, of which the first was found in Germany, Northern France, Belgium, Holland, and Switzerland, and was distinguishable all the year round by its bright red colour. In the North and East, the Central European Squirrel met and intergraded with a lighter red form, which in winter became almost grey, while the typical *S. vulgaris* of Linnæus would appear to be restricted to a comparatively small area in South Scandinavia. The latter approached nearest to *S. leucurus*, but was at once distinguishable by the redness of the tail, which, moreover, did not bleach. To all these forms, except the typical *S. vulgaris*, the names given to them by Robert Kerr in 1792 appeared to be applicable. Their distribution was in accordance with what might be expected from a knowledge of the existing climatic conditions of Europe; and it was interesting to find the milder portions of Scandinavia inhabited by a Squirrel which approached more nearly to the British than to any other form. The occurrence of this form might be parallel to that of a Wren, *Troglodytes bergensis*, which had been described by Stejneger from South Scandinavia. It was also interesting to find that the light red Squirrel of Northern Scandinavia, Lapland, and Russia occurred farther south in proportion to the extension of its range eastward and inland, and was thus found in Poland, Eastern Prussia, and Hungary.

Of the Squirrels of South Europe he had nothing to say for the present. For the proper appreciation of the local colour-variations of the common European mammals a large series of skins collected in different localities was essential, and the little already accomplished towards the accumulation of such a series had been largely due to the energy of Mr. Oldfield Thomas.

The following was a brief diagnosis of the colour-distinctions of the European subspecies of *Sciurus vulgaris*, together with that of one subspecies from Siberia:—

Sciurus vulgaris rufus Kerr, Animal Kingdom, p. 255 (1792).

Hab. Central Europe: North of France, Belgium, Holland, Germany (except the east), Switzerland, and parts of Northern Austria.

Colour—of ear-tufts, body, and tail red all the year round, the

winter coat in perfectly typical specimens only differing from that of summer in its much greater thickness. I have seen specimens from a number of German localities, in the more northern of which the winter coat contains a more or less amount of white or grey hairs on the flanks, thus intergrading with the next subspecies.

Sciurus vulgaris varius Kerr, *op. cit.* p. 256 (*nec* Pallas, Zoogr. Ross.-As. 1831, i. p. 183).

Hab. Northern Scandinavia, Lapland, Northern and Central European Russia, Poland, East Prussia, parts of Hungary, and Western Siberia.

Colour—in summer red, but lighter than *S. rufus*; in winter the body is more or less completely shining grey, nearly white, with the tail and ear-tufts red. In some specimens there is also a trace of the red colour on the dorsal line, head, and legs.

Sciurus vulgaris typicus.

Hab. South Norway and Sweden.

Colour—in summer the body resembles in its brownish-red tints that of *S. leucurus*, but the tail is red, and does not bleach when the hairs are old and worn; in winter, the body-coat is composed of soft greyish-brown hairs, the summer tints remaining visible to a variable extent on the dorsal line and legs.

Sciurus vulgaris calotus Gray, Ann. Mag. N. H. xx. p. 272 (1867).

Hab. Eastern Siberia, the exact limits uncertain; but specimens in the British Museum labelled as from Wilni (Siberia), Seoul (Corea), Southern Manchuria, Sachalin Island, Pekin, and Nepal all appear to belong to a single form.

Colour—in winter darker than *S. varius*. I have seen no summer skins which are not melanisms, but a winter skin which I purchased at Hakodate, Yezo Island, shows a trace of rufous colour on the central dorsal line.

This subspecies might possibly prove to be identical with that from the River Obi, to which the name of *S. vulgaris argenteus* had been given by Kerr (*op. cit.*).

In conclusion Mr. Barrett-Hamilton said that he ventured to suggest that when a further knowledge of the local variations of European mammals should have been gained, it might be found that the European Continent might be divided, for the purposes of study of the geographical distribution of mammals, into some such areas as those represented by the different subspecies of Squirrels to which he had now drawn attention.

The following papers were read:—

I. General Account of a Zoological Expedition to the South Seas during the years 1894–1897. By Arthur Willey, D.Sc. Lond., Hon. M.A. Cantab.

[Received January 16, 1899.]

The main object of my recent journey to the South-west Pacific was the investigation of the life-history of the Pearly Nautilus. My first destination was the Island of New Britain (Neu-Pommern) in the Bismarck Archipelago, as this had already become known as a locality where living Nautiluses could be obtained in abundance. The principal difficulties which had to be coped with were owing to the comparatively deep water—50 to 70 fathoms—in which *Nautilus pompilius* lives. It is only to be caught at night—both in Blanche Bay and in Talili Bay, on opposite sides of the Gazelle Peninsula—in native fish-traps baited with small fish. After finding the tracts where Nautiluses congregated in shoals at night, I would, on the following morning, go over the same ground with the dredge. Almost always the dredge would come up full of pumiceous fragments. In fact I came to the conclusion in New Britain, which I afterwards confirmed in the Loyalty Islands, that the feeding-ground is not the breeding-ground of the Nautilus—or, in other words, that the Nautilus migrates in shoals nocturnally from deeper into shallower water in quest of food. The Nautilus will eat any animal-food which is offered to it, from a fowl to a sea-urchin, and from a langouste to a shrimp, but its natural food consists chiefly of small Decapod Crustacea.

When attacking a shrimp, for example, the Nautilus darts forward with great rapidity, and enclosing the victim within its tentacular complex seizes it between its powerful beak-like jaws. It can protrude its body by action of protractor muscles far beyond the mouth of the shell, but it only does this when occasion demands. When normally swimming, the body is slightly raised as to completely expose the eyes above the level of the margin of the shell, and to allow free entrance for the water into the mantle-cavity and exit through the cleft siphon. Like all the other Cephalopods, Nautilus swims backwards with considerable speed. It holds the shell, when swimming, in one position only, namely with the spire and with the mouth of the shell directed upwards, as shown in the photograph here exhibited. Nautilus is incapable of capsizing its boat as described by Rumphius.

After spending the best part of a year in New Britain, during which I made new observations upon the vascular system and branchial sense-organs, I determined to change my base, and accordingly proceeded to the Eastern Archipelago of British New Guinea. Meanwhile, however, I had made a prospecting journey to New Hanover, where I found the natives baling out their canoes with Nautilus-shells. I made no further progress during the five months I spent in New Guinea so far as Nautilus is concerned,

but I captured four specimens of *Ctenoplana*[1], which yielded a number of results of some interest. This remarkable form, half Ctenophore and half Plathelminth, had previously only been obtained as a unique specimen by the Russian naturalist Korotneff, off the west coast of Sumatra in 1886. Korotneff's account was inaccurate in many details, and his discovery of the type was regarded with some scepticism. My re-discovery of this creature is therefore matter of satisfaction. All four specimens were taken from a drifting cuttle-bone off the Conflict Lagoon in the Louisiades, British New Guinea.

From the Deboyne Lagoon, in the same Archipelago, I obtained a species of *Amphioxus* belonging to the subgenus *Asymmetron*, previously known only from the West Indies. This is a remarkable fact of distribution, since in the Torres Straits, which are comparatively close by, there are two species of *Amphioxus* belonging to other subgenera.

When I revisited New Guinea on my return for the second time to New Britain, I was fortunate in securing the only specimen ever seen of the animal of *Nautilus umbilicatus*, which had been taken from the surface off the East Cape of British New Guinea. Nautilus does not come to the surface normally according to my observations, and all specimens which are taken from the surface are probably in a moribund condition. This was the case with the specimen obtained by Dr. Bennett, upon which Sir Richard Owen based his classical work on *Nautilus*.

My object in changing my locality from time to time was for the purpose of finding a place where Nautilus could be more easily got at. After much misgiving and disappointment, I at last found such a place—namely, Sandal Bay, Lifu, in the Loyalty Group. In this place Nautilus migrates at night from deep water into as little as three fathoms. It comes quite close to the shore. The species occurring here is *N. macromphalus*. So far as I have ascertained at present, this species only differs from *N. pompilius* in the character of the umbilicus of the shell. The animals are almost identical. *N. umbilicatus* differs strikingly in external appearance from both of the preceding. After an absence from England exceeding two years, I induced Nautilus to deposit its eggs in my cages. The eggs are firmly fixed to a suitable surface: the best artificial surface which can be offered to the Nautilus is sacking, the fibres of which are entangled in the hardened milk-white capsule of the egg. I have described these eggs in the 'Proceedings of the Royal Society' (1897). Neither in Lifu nor subsequently in New Britain, where I got the eggs of *N. pompilius*, was I able to rear embryos from the deposited eggs—such was the effect of captivity.

The geographical distribution of *N. macromphalus* is interesting. It is confined rigidly to the New Caledonian Archipelago. In the neighbouring New Hebrides and in Fiji, *N. pompilius* is again met with.

[1] See Q. J. M. S. vol. xxxix. 1896, p. 323.

During my various changes of venue I accumulated a rich material of Enteropneusta, an account of which I shall shortly publish in Part III. of my Zoological Results which are being issued by the Cambridge University Press.

Lastly, it was my happiness to discover a new type of *Peripatus* in New Britain which differs from the South African, Australasian, and Neotropical subgenera in the same respects—anatomy and development—in which they differ from one another. It constitutes therefore a fourth subgenus, which I have called *Paraperipatus*. With regard to *Peripatus*, the next point of interest centres upon the new species—*P. tholloni*, which has recently been described by Mons. E. L. Bouvier from the Gaboon district (West Africa).

2. On Characteristic Points in the Cranial Osteology of the Parrots. By D'Arcy W. Thompson, C.B., F.Z.S.

[Received November 16, 1898.]

To discover anatomical characters such as might yield or help to yield a natural classification of the Parrots has been the desire of many ornithologists, but the search has availed little. Garrod's abundant work has told us many facts in regard to the presence or absence of an ambiens, of an oil-gland, of one carotid or two, and other varying characters in a multitude of species; but when we come to put these data together the result is unsatisfactory, and one is left with the impression that the several series of facts are incoordinate and cannot be linked together in a single system. When we find, for instance, that the collation of these facts places in a single group *Ara*, *Psittacus*, *Pœocephalus*, and *Nestor*, and in another *Stringops*, *Melopsittacus*, and *Agapornis*, one is tempted to think that the only thing proved is that the data are invalid or antagonistic—in other words, that the several structures had really followed diverse or parallel or convergent lines of modification and evolution. While such internal structures seem to me to lead to confusion by indiscriminate variability, the characters of the skeleton are generally deemed too monotonously alike to present features of significance. Even in *Stringops*, the osteological peculiarities of which are greater than those of any other form (except perhaps *Nestor*), they are yet not conspicuous enough to have prevented certain recent writers from remarking that the divergence of *Stringops* from the other Parrots is not so great as it had been supposed to be.

There is indeed in most parts of the skeleton a very great uniformity throughout the order, but in certain parts, for instance the orbital ring (where the differences are well known, though imperfectly investigated)[1], the hyoid bone (as Dr. St. G. Mivart has

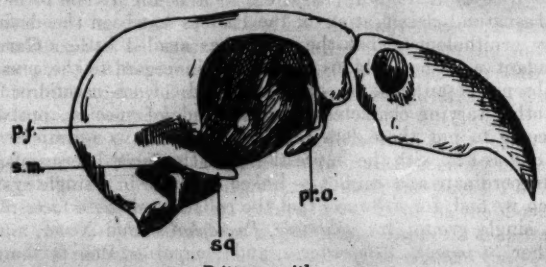
[1] *Cf.* Em. Blanchard, "Caractères ostéol. chez les Ois. de la famille des Psittacides," C. R. xliii. pp. 1097–1100 (1856), xliv. pp. 518–521 (1857); C. L. Bonaparte, *ibid.* xliv. pp. 534–539 (1857).

shown), the auditory region, and the quadrate bone, there are very numerous conditions to be distinguished, which appear likely to help in the search for natural affinities.

The following pages contain an account of the skull in different genera, with particular reference to three of the above-mentioned characters. The descriptions and figures are taken partly from specimens in my own collection, which is considerable, and partly from skulls belonging to the Royal College of Surgeons and to this Society, for the opportunity of studying which in Dundee I am very greatly obliged to Mr. C. Stewart and to Mr. Beddard. The genera are described for the most part in the order of Count Salvadori's British Museum Catalogue, and I attempt to show in the sequel certain cases where osteology suggests a different arrangement.

The accompanying diagrams of the skull and quadrate of *Psittacus erithacus* (figs. 1 & 2) show the characters to which attention will be chiefly drawn in the descriptions.

Fig. 1.



Psittacus erithacus.

pr.o., preorbital or prefrontal process; *p.f.*, postfrontal process; *sq.*, squamosal *s.m.*, suprameatal tubercle.

From the hinder border of the orbit a process projects downwards and forwards which we may call the *postorbital*, or, as I prefer to call it, the *postfrontal* process: it is also called by Dr. Mivart [1] the sphenotic process. I may remark that this is only one of many cases where we remain in doubt as to what nomenclature to use, for want of knowledge of the facts of embryology. Parker, in his account of the Fowl's skull [2], where this process is not unlike that of many Parrots, describes its development from a separate element, the postfrontal, and it certainly seems to me, from a study of such material as I possess, to be developed both in the Fowl and in Ratites from a frontal or postfrontal element, with which a process of the alisphenoid may be associated. It is sometimes ascribed, as by Gadow [3], to the squamosal bone, which

[1] Mivart, Skeletons of *Lorius* and *Psittacus*, pt. ii., P. Z. S. 1895, p. 363.
[2] Parker, Phil. Trans. 1869, pt. ii. p. 790.
[3] Gadow, Newton's Dict. of Birds, p. 873.

is then said to be continued into *two* lateral processes, and it arises, at any rate, very near the meeting-place of the frontal and squamosal, which may very possibly both be found to contribute to its formation.

Separated from this postfrontal process by the temporal groove or fossa is the zygomatic process of the squamosal, which it is more convenient to call the *squamosal* process; this, in the Grey Parrot, is the larger and longer of the two. It is seen to be slightly indented below near its apparent origin from the skull, and to jut downwards behind the slight indentation (much more conspicuous in certain other forms) which marks the place where the glenoid cavity for the outer head of the quadrate is excavated below. A slight tubercle projects outwards from, or rather behind, the base of the zygoma, behind the glenoid indentation, and is the *suprameatal* process of Mivart (*l. c.*); between it and the glenoid notch is a small grooved area which in some genera becomes conspicuous. I shall speak of it as the suprameatal area. From the anterior lower margin of the orbit there runs, curving backwards, and crossed near its origin by a well-marked horizontal groove, the *preorbital* or suborbital process, which represents the posterior process of the so-called lachrymal bone. We shall find that the relative size of these processes, their fusion or want of fusion to complete or leave incomplete the orbital ring, and the completion of the orbital ring by union of the lachrymal in some cases with the postfrontal, in some also with the squamosal process, furnish us with several important distinctive characters.

While it is not the object of this paper to deal with the higher morphological questions, I may point out that the so-called lachrymal bone is (at least in my opinion), obviously no lachrymal, but a prefrontal (with which in some cases an inconspicuous lachrymal may be conjoined), as nearly as possible identical in its characters and relations with the prefrontal of the Lizards. The bone in a lizard (e. g. *Iguana*) comes into relation with the frontal, nasal, lachrymal, superior maxillary, jugal, and palatine bones. Its dorsal portion, precisely comparable in most birds to its dorsal ramus in the Lizards, is in relation with the nasal and frontal. Though it does not in any one bird exhibit all the other relations of the lacertilian bone, yet we may discover them severally in one bird or another: in the Snowy Owl, in *Balæniceps*, and in *Podargus* it meets or unites with the maxilla; it comes into relation with the palatine in *Struthio* and *Apteryx*; it meets more or less intimately with the jugal in the Penguins, Petrels, Cormorants, *Gypogeranus*, and others; while in the Raven and many other Passerines, the Penguins, the Guillemots, the Curlew, the Toucan, the Parrots, and many more, it comes into relation with, or fuses with, the ethmoid region, a relation that we cannot seek in the bony skull of the Lacertilia. In Ducks, Geese, and Swans its inferior ramus inclines backwards in the direction of the postfrontal process (the squamosal or zygomatic process being here absent or rudimentary), as it does in the Parrots, and it is said (though I have not actually

seen a case) that in certain of these Anserine birds the two unite in a suborbital ring.

In some birds, but not in very many, this bone presents, in its anterior wall, a conspicuous foramen, which is especially well seen, for instance, in *Rhea*, *Struthio*, and *Apteryx*; but it must not at all be confused, as in certain birds it might possibly be apt to be, with the chink formed between prefrontal, frontal, and ethmoid in those birds where the first meets with the last of these three bones: in Parrots this chink is represented by the inner and outer precranial foramina of Mivart, a subdivision already incipient even in the Raven. Where we find the foramen in the Ratite, we in most other cases find only a groove on the outer side of the prefrontal, shallow in the Raven and the Parrot, deep in many Passerines, e. g. *Acridotheres*, in *Dacelo*, in the Herons, very deep in the Penguins, the Eagles, Vultures, &c.

It seems to me more than probable that where we have this foramen developed its outer wall is contributed by a true lachrymal, precisely as the similar foramen is bounded by the prefrontal and lachrymal in *Iguana*; but that in the other cases we have good grounds for abandoning the term lachrymal, and accepting the bone in question as a true *prefrontal*[1].

The lacertilian skull gives us no very close parallel to the very remarkable suborbital arcade of the Psittacidæ, but we may trace in it an indication of the latter's constituent parts and probable method of formation. The postfrontal runs in the Lizards, perhaps still more in *Hatteria*, a long way down the inner and anterior side of the superior or ascending ramus of the jugal, that ramus which in birds is aborted, as is the posterior one in the Lacertilia. It is but crossing a very little gap for the prefrontal and postfrontal to join below, and, separating from contact with maxillary and jugal, to form such a suborbital bar as we find in *Stringops*, *Ara*, or *Chrysotis*. And the junction between the two postorbital processes, that is to say the postfrontal and squamosal processes, that we find in the Cockatoos, will be seen simply to enclose a supratemporal arcade, bounded by the same bones and occupied by the same (temporal) muscle as it is in its vastly greater development in the Lacertilia.

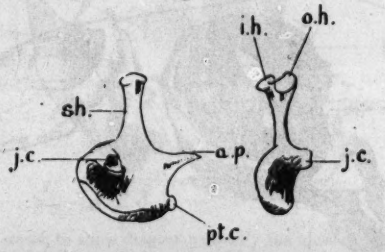
The auditory meatus or tympanic orifice is surrounded by an imperfect ring of bone, irregular in outline, of whose real constitution we are again left somewhat in doubt. It seems plain that its upper border is contributed by the *squamosal*, possibly in part by the opisthotic, its outer or posterior border by the thin, shell-like extension of the *exoccipital*, while in regard to its anterior and inferior portions we may assume that they are formed by the *basitemporal* of Parker. Within, this tympanic chamber is produced above into the *superior*, below and behind into the

[1] In Huxley's 'Anatomy of Vertebrates,' where this bone is described, as usual, as a lachrymal, what is spoken of as the prefrontal is expressly defined as the equivalent of the lateral mass of the ethmoid in Mammals, and the term is thus used in a sense now entirely obsolete.

posterior, below and in front into the long compressed or pointed *anterior tympanic recess*. A bar of bone, part of the proötic, runs forwards near the middle of the cavity, bounding the lower border of the superior recess, and bearing anteriorly the articular surface for the inner head of the quadrate bone, immediately below which is the tiny orifice of the canal for the external ophthalmic artery. Into the posterior recess, below the fenestræ ovalis and rotunda, opens from behind the large aperture which transmits the so-called tensor tympani muscle, and the recess itself runs backwards and downwards externally to the orifice, within the so-called paroccipital process.

In the Grey Parrot the tympanic orifice is moderately wide: looked at from a little to the front it is very nearly semicircular; from a little way behind it appears crescentic, from the manner in which the slightly curving border of the posterior or exoccipital wall encroaches on the front of the cavity. The nearly straight but slightly curving posterior border, the somewhat angular notch above, and the more pointed notch below, that are visible in the figure, are the chief points that catch the eye. We shall find that the shape of the tympanic orifice and the extent to which the cavity is walled in differ much in the different genera, and chiefly in relation to the extent of development of the posterior wall; and that we have great concurrent variation in the area between the auditory meatus and the descending occipital ridge. In some cases, in correspondence with the shape of the quadrate bone, the glenoid cavity for its inner head will be found widely separate, in others scarcely separate or not at all, from the squamosal facet for its outer one. And again the relative dimensions of the recess will be found to vary, the posterior one in particular being sometimes very greatly reduced.

Fig. 2.



Quadrate bone of *Psittacus erithacus*.

i.h., *o.h.*, inner and outer heads; *sh.*, shaft; *a.p.*, anterior process; *j.c.*, jugal cup; *pt.c.*, pterygoid condyle, distinct from and in front of the long mandibular condyle.

The quadrate bone (fig. 2) shows us a long, straight, slender *shaft*, and a flattened *body*, whose lower margin, almost circular in contour, forms the elongated simple articular surface, playing in

the antero-posterior groove that constitutes the unusually simple glenoid cavity of the mandible. In front of this lower articular margin of the quadrate is a small but distinct rounded head or condyle for the pterygoid. An anterior process, small, short, and sharply pointed, runs forwards, at an obtuse angle to the shaft of the bone. The shaft has two heads, the external or squamosal one being large, the inner or proötic one much smaller and separated from the outer by a very shallow groove: a pneumatic foramen enters the shaft on its inner side, below the proötic capitulum. A cup for the quadrato-jugal articulation is directed outwards and forwards, and stands elevated on a tubercular mass of bone, whose posterior surface forms a conspicuous ridge; on the sloping ridge *below* the cup is a small accessory articular surface, which plays against the edge of the mandible (*cf.* Mivart, pp. 374, 391), and whose comparative anatomy is more fully discussed below. We shall find that the quadrate is markedly different from this in *Stringops*; and that in the other genera considerable but less important differences exist in the greater or less separation of the two capitula, the size of the anterior process, the distinctness of the pterygoid condyle, and the conformation of the parts adjacent to the quadrato-jugal cup.

Family Nestoridæ.

In all the characters with which this paper is mainly concerned the skull of *Nestor* (figs. 3, 6) is extremely interesting.

The orbit is incomplete. The postfrontal process is rudimentary; the prefrontal process is long, evenly curved, and reaches nearly to the squamosal. The squamosal region is entirely different to that of any other Parrot. The squamosal or zygomatic

Fig. 3.

Nestor notabilis.

pf., postfrontal process; *sq.*, squamosal.

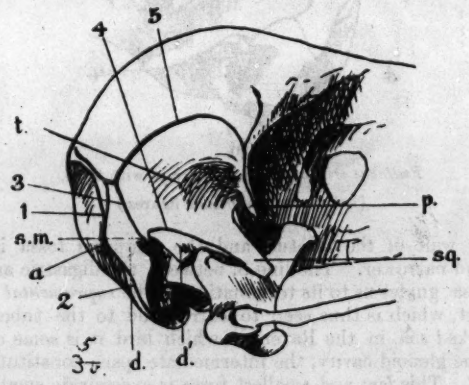
process, instead of being slender and free on its lower or posterior margin, is continuous with a flattened buttress of bone which connects it with the main body of the squamosal, and which descends

in a broad, somewhat excavated shelf to overlap (as well as to project in front of) the head and upper portion of the shaft of the quadrate bone. This squamoso-zygomatic plate is deeply hollowed on its outer face, suggesting perhaps the presence of a highly specialized muscle (probably the second portion of the digastric) originating there. The lower border of the overhanging shelf is slightly bilobed, especially in another specimen in my collection from that figured. The posterior portion or posterior lobe, and perhaps the whole hollow on the outer face of the bone, may be considered to be an extension of the region internal or anterior to the "supra-meatal" process of Mivart, a region which in most Parrots forms only a small facet; its aspect here, together with the general conformation of the bone, reminds us how in a Lizard the squamosal tends to overlap the outside of the quadrate in a way which culminates in the great descending limb or process of the bone that bounds the infratemporal arcade in *Hatteria*.

I know no other bird in which a very similar condition of things is to be seen; but we may discover in some Passerines, *e. g.* the Raven, a certain correspondence of parts.

If we trace in the Raven (fig. 4) the ridges and muscular impressions on the postero-lateral surfaces of the skull, we see (1) on the upper margin of the supra-occipital region two curved trans-

Fig. 4.



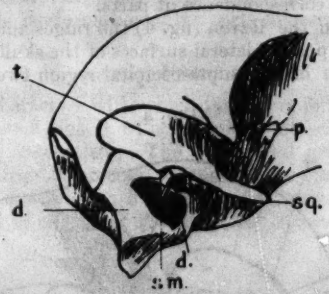
Corvus corax, to show diagrammatically the muscular fossæ and intervening ridges.

s.m., suprameatal tubercle; *sq.*, squamosal; *t.* temporal, *d.* digastric fossa; *d.'*, fossa for second head of the digastric, in front of *s.m.*, the suprameatal tubercle. The ridges or outlines of the muscular impressions are described in the text.

verse ridges which run outwards from the middle line to a tubercle (*a*) posterior to and nearly on a level with the upper border of the auditory meatus; (2) an undivided ridge curves downwards from

this point to the outer margin of the paroccipital; (3) springing from the upper of the two supra-occipital ridges, a little way before they reach the tubercle and merge together, a ridge curves downwards to another tubercle (*s.m.*) at the upper and hinder corner of the meatus; and (4) from this latter tubercle a ridge is continued towards the inferior border of the squamosal or zygomatic process; the temporal fossa is bounded above by (5) the great curved line which runs from near the base of the line called 3 to the apex of the postorbital process. These lines separate the following areas or fossæ: I, a narrow triangular area, posterior to the auditory region, which gives origin to the main body of the digastric; II, the temporal fossa, and III, the small space below the line marked 4, which gives origin to the second portion of the digastric muscle. In the Grey Parrot (fig. 5) we can distinguish all these lines and intervening areas; but the digastric area is much broader than in the Raven, owing to the greater extension forwards of the thin

Fig. 5.



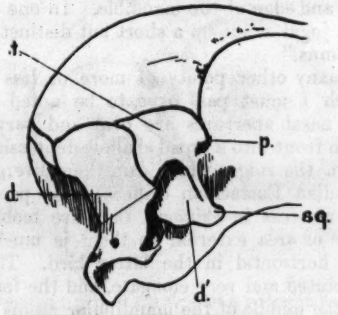
Psittacus erithacus, for comparison with fig. 4.

(Letters as in previous figures.)

posterior wall of the meatus, and the temporal fossa is much longer and narrower. The line 3, between the digastric and temporal fossæ, guides us to its termination in the *suprameatal* process of Mivart, which is thus seen to correspond to the tubercle we have marked *s.m.* in the Raven, in which bird it is some distance behind the glenoid cavity, the intermediate space constituting our fossa III. This last and smallest fossa is excessively small in the Grey Parrot (fig. 6, p. 17), being only represented by a groove between the suprameatal tubercle and the little process of the squamosal internal to it, which descends for a very short distance external and posterior to the head of the quadrate—in other words, which bounds the inconspicuous notch over the head of that bone. To return to *Nestor* (fig. 6), a comparison of the same clearly marked impressions shows us a still larger digastric and smaller temporal fossa, and leads us to recognize the suprameatal process in that one which is now separated widely from the glenoid cavity by the

deep excavation behind the squamosal or zygomatic process which is so marked and exceptional a feature in this bird, but which we now discover to be a huge development of the tiny groove in *Psittacus*, and of our IIIrd fossa in *Corvus*; and we further see that the opposite or inner wall of this last fossa, which so deeply overlaps and overhangs the head and shaft of the quadrate, is precisely comparable to that little process which did likewise, but to a slight degree, in the Grey Parrot and the Crow.

Fig. 6.



Nestor meridionalis, for comparison with figs. 4 & 5.
(Letters as in previous figures.)

The tympanic cavity is of moderate size, widely open when we look at it from in front, but in its lateral aspect almost concealed by the forward growth of the scroll-like posterior wall; the cavity has a deep posterior recess, descending to near the apex of the paroccipital process, where is a large oval foramen for the so-called tensor tympani. The lower and anterior border of the meatus, as it bends upwards, quite distinctly shuts out the region of the quadrate articulation from the boundaries of the tympanic cavity.

The quadrate bone (fig. 7) has two widely separate capitula, the

Fig. 7.

Quadrate bone of *Nestor meridionalis*.
(Letters as in previous figures.)

inner one being in a considerable degree the smaller; but the double socket for these heads, though constricted in the middle,

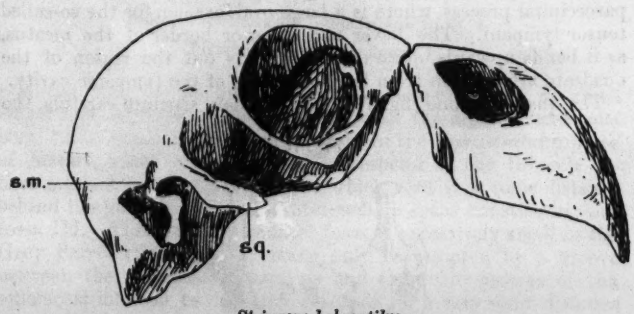
is continuous and not divided into two. The pterygoid condyle is well-marked, and more distinctly separate than usual from the long mandibular condyle. The chief peculiarity in the bone is in the region of the quadrato-jugal cup, which is more than usually elevated from the flat surface of the bone, the tubercular mass on which it stands being produced above into a sharp ridge, and being directed outwards or even a little backwards instead of forwards, as is commonly the case. The whole under surface of this protuberance, together with the outer face of the body of the bone down to the condyle, plays on a corresponding articular surface on the inner wall and edge of the mandible. In one of my specimens of *Nestor* the jugal sends up a short but distinct rudiment of an "ascending ramus."

There are many other points of more or less importance, but many of which I must pass over, to be noted in the skull of *Nestor*. The nasal apertures are oval and very large, and are hollowed out in front into a broad shallow depression. On the base of the cranium the ridges which run their divergent course from below the median Eustachian orifice to the paroccipital process are very high, whereas in *Psittacus* they are feeble, and the well-marked surface or area external to them is much more flat and approximately horizontal in the latter bird. The angle of the mandible is pointed and very elongate, and the foramen, or rather fontanelle, in the middle of the mandibular ramus is oval and very large.

Family Stringopidæ.

The skull of *Stringops* (figs. 8, 9) is very remarkable, only less so on the whole, and more so in some respects, than that of *Nestor*.

Fig. 8.



Stringops habroptilus.

(Letters as in previous figures.)

The orbit is complete (in the adult) by union of the prefrontal with the postfrontal; in other words, the orbit of *Stringops* is unlike that of any other Old-World Parrot, and resembles that of

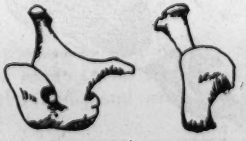
Chrysotis and the Macaws. The orbit is of remarkably small size, its antero-posterior diameter being about equal to that of *Prittacus erithacus*, and a little less than that of *Eclectus cardinalis*. The squamosal process is large and flattened; it runs parallel to the posterior portion of the suborbital ring, and the temporal fossa between is unusually deep and wide. The suprameatal process is large, and overhangs a deep groove or hollowed plate of bone that

Fig. 9.

Stringops habroptilus: part of the skull of a young individual, for comparison with figs. 4, 5, 6.

lies posterior to the quadrate articulation and above the auditory meatus, roofing over the superior auditory recess; it is comparable to, though far smaller than, the remarkable area connecting the auditory cavity with the hollowed surface of the squamosal in *Nestor*. The anterior border of this bony plate forms a well-defined margin to the quadrate articulation, which is thus very distinctly separated from the auditory cavity. The auditory meatus is rounded and wide open; its posterior wall scarcely diminishes its aperture. The basitemporal plate is on a level with the occipital condyle; its edges are formed by elevated ridges that run back to the nearly vertical paroccipitals, and the lateral areas continued forwards from these latter are sharply inclined. The intraorbital vacuities are very large. The quadrate bone (fig. 10) is especially remarkable, and

Fig. 10.



Quadrate bone of *Stringops*.

in it the Psittacine type of quadrate is imperfectly attained. The shaft of the bone is shorter and less vertical than usual, the

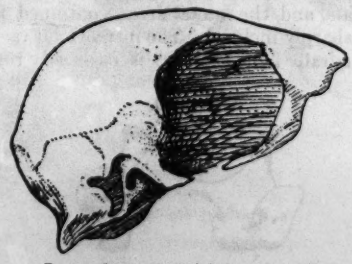
anterior process much larger and blunter, the whole body of the bone more expanded, and the glenoid surface more elongate and less curved. The pterygoid condyle is independent, and set about halfway between the main condyle and the base of the anterior process. The quadrato-jugal cup looks nearly forwards, and is set on a powerful ridge of bone that forms a sharp free edge as we look at it from the hinder or outer sides. Immediately below the quadrato-jugal cup, on the underside of the prominent ridge, is an articular facet which plays on a corresponding surface on the edge of the mandible. The inner head of the quadrate bone is comparatively large and imperfectly separated from the outer one. The descending processes on the hinder border of the maxillæ are large. The usual mandibular fenestra is obsolete, but a small one is present (represented in a good many other forms by a small foramen) apparently between the articular and splenial elements. I have not seen a complete hyoid, and can only say that the para-hyals are uncommonly large and point upwards.

The skull of *Stringops* represented in fig. 9 is that of a young or half-grown individual, in which the orbit is still incomplete. The circumstance is natural enough, but it may serve to remind us that the completeness or incompleteness of the orbit is not, after all, a very deep-seated morphological difference; it is merely a case of greater or less extension of ossification in a ligamentous connection that is already there.

Family Loriidæ.

Dr. Mivart has lately given us a copious description of the skeleton of *Lorius flavopalliatus*. My account shall deal only with the points that seem to me of chief importance. I have studied four forms, *Eos riciniata*, *Lorius domicella* (fig. 11), *Trichoglossus ornatus*, and *Glossopsittacus*, sp.; these are all so similar in their main features that their descriptions may be incorporated together.

Fig. 11.



Lorius domicella (slightly enlarged).

The postfrontal process is in all of them small, largest in *Eos*, and least in *Lorius*. It is in the form of a nearly vertical ridge

with a very short free extremity, and the fossa for the temporalis muscle is seen to extend upwards behind it, instead of being merely overhung by it as in *Psittacus*. The squamosal process is well developed, rather long and pointed at the end; it is somewhat shorter and broader in *Lorius* than in the others. The posterior ramus of the prefrontal is well developed and extends behind the middle of the orbit; but it does not create a suborbital ring, though, especially in *Trichoglossus* and *Eos*, it may come very near to the squamosal.

The posterior wall of the tympanic cavity is formed after the fashion of *Psittacus*, but leaves an aperture of an apparently different shape, by reason of the greater forward growth of its middle portion, so that the crescentic form of the aperture, or rather the development of a conspicuous notch below and another above and posteriorly, is better marked. The latter or upper notch is just below and behind the suprameatal tubercle. The anterior wall of the tympanum shows (in all four genera) an ascending bar or splinter of bone that walls off from the tympanic cavity the articulation of the quadrate. This is a little point of resemblance to *Nestor*, but it is the only one I can detect, and unsupported it goes for nothing. The groove or area in front of the suprameatal process is well-marked; it is very much more extensive than in *Psittacus*, for it extends into an excavated surface on the squamosal process, reaching well in front of the glenoid notch. The jugular foramen is exceedingly small, and the posterior recess of the tympanum not large.

The quadrate has two deeply separated heads; the inner one is very small and bent inwards almost perpendicularly to the shaft. The two sockets on the squamosal and proötic elements are distinctly and rather widely separate, and the latter is a small deep hollow.

The mandibular fontanelle is a minute orifice placed much further back than in *Psittacus*. The basitemporal ridges are better marked than in *Psittacus*, but they distinctly terminate below the foramen for the vagus, and are separated by a notch from the succeeding ridge which marks the under border of the paroccipital. It is true that both in *Nestor* and *Psittacus* there is at the same point a slight change of direction and appearance of discontinuity, but, especially in the former skull, the ridges are nearly continuous.

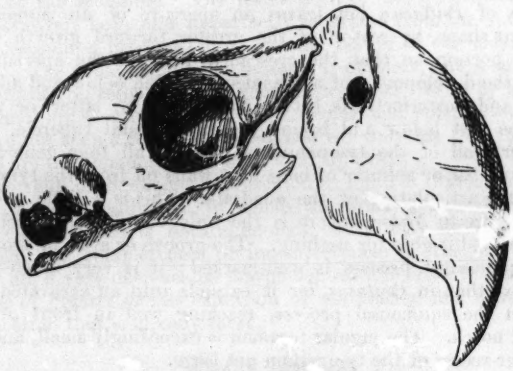
Family Cacatuidæ.

The Cockatoos possess certain cranial characters in common and their skulls are easily to be recognized, but there are many variations within the family and even within the restricted genus *Cacatua*.

The orbital ring is complete by union of the prefrontal and postfrontal bones, and from the hinder part of the suborbital bar thus formed a strong process runs backwards to fuse, in most cases though not in all, with the squamosal process, and thus (as has been

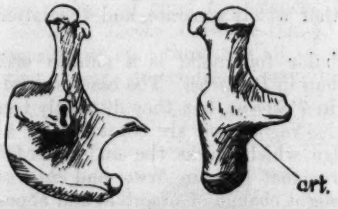
mentioned above) to bound a supratemporal fossa. We do not know whether this process is actually developed as a mere continuation of the prefrontal or as a posterior offshoot of the postfrontal, because postfrontal and prefrontal are in all Cacatuidæ intimately fused; but I am inclined to anticipate that examination of young individuals would show it to be an outgrowth of the postfrontal, and to correspond precisely to the posterior or squamosal ramus of that bone in the Lacertilia.

Fig. 12.



Microglossus aterrimus (redu[illegible]).

Fig. 13.



Quadrate bone of *Microglossus aterrimus*.

art., the accessory articular surface beneath the jugal cup for articulation with the edge of the mandible.

The only Cockatoos in which I have observed this supratemporal fossa to remain incomplete are *C. ducorpsi* (fig. 14) and *Microglossus aterrimus* (fig. 12), and here we appear to have the posterior outgrowth or ramus of the postfrontal developed, though not to such an extent as to fuse with the squamosal process. Blanchard (C. R. 1856, p. 1098) says the same of *Calyptorhynchus xanthonotus*, but in *C. banksi* (fig. 10), which I have examined, the fossa is complete and the whole region much as in other Cockatoos.

In *Cacatua* the auditory meatus is somewhat narrowed, much as in *Psittacus*, but to a varying degree in different species. In *C. roseicapilla* the ingrowth of the posterior wall is particularly well marked, and leaves a large circular notch above, where in *Ps. erithacus* we had a more pointed indentation; in *C. gymnopus*, on the other hand, the posterior margin is convex rather than concave: but though less marked in *C. roseicapilla* than in the rest, it is very characteristic of the Cockatoos that the region between the descending occipital ridge and the posterior wall of the auditory meatus is extremely narrow. We shall see that this, which perhaps deserves to be spoken of as the digastric area, differs greatly in extent in the different groups of Parrots. The suprameatal tubercle is distinct, and the triangular area below and in front of it is larger than in *Psittacus*. The region of the squamosal process overlapped by the fused posterior ramus of the prefrontal forms in *C. roseicapilla* a prominent projection extending backwards and downwards to overlap the shaft of the quadrate bone; but in *C. leadbeateri* and *C. ducorpsi* this is not the case, the

Fig. 14.

Cacatua ducorpsi.

posterior or inferior margin of the squamosal process running evenly forward and downward as in *Psittacus*. The paroccipital processes are large and point somewhat backwards; the basitemporal ridges are prominent, but not continued directly on to the under surface of the paroccipital. The occipital condyle is considerably above the level of the base of the skull. The mandibular fontanelle is very small or obsolete. The paroccipital is but slightly excavated within; the jugular foramen is small, except in *C. ducorpsi*, where it is considerably bigger. The two facets for the heads of the quadrate bone are distinctly separated by a ridge. The two heads of the quadrate are wide apart, and the inner is rather large, more than half as large as the outer. The pterygoid condyle is distinct, and in *C. roseicapilla* is more distinct than in the others from the main condyle or mandibular articulation. The shaft of the quadrate is distinctly stouter than in *Psittacus*, and the upper posterior portion of the body above the quadrato-jugal cup is not rounded off as in that genus, but conspicuously prominent.

The skull of *Licmetis* (fig. 15) has certain peculiarities. The postfrontal process is exceedingly broad, both in its descending and its posterior ramus, and the supratemporal fossa is accordingly restricted in size. The tympanic cavity is wider open than in the others, the posterior wall encroaching little; in this respect it resembles the skull of *C. roseicapilla*. The inner head of the quadrate is exceptionally large. The paroccipital processes are

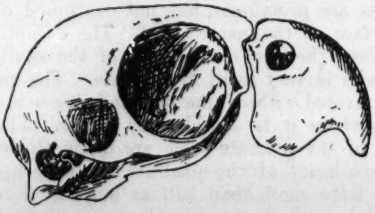
Fig. 15.

Licmetis nasica.

rather short but very large, and looked at from behind form a *transverse* ridge; the area below them and between the meatus and the basitemporal ridges is very well defined, constricted in the middle into a peculiar shape by the lower notch of the meatus and the interruption between basioccipital and paroccipital ridges, and nearly horizontal. The angle of the mandible is more elongate and pointed than in the other Cockatoos.

In *Calyptorhynchus banksi* and *Callocephalon galeatum* (fig. 16) the orbital ring is formed in the manner characteristic of the Cockatoos, and the region of the squamosal process sends off no

Fig. 16.



Callocephalon galeatum.

projecting lobe such as I have described in *C. roseicapilla*. In *C. galeatum* the supratemporal fenestra is wide, and the surface for the origin of the temporal muscle exceptionally large, extending far back on to the posterior surface of the skull. The

auditory meatus in both is wide, and its posterior border concave. The paroccipitals are prominent, pointed, and directed backwards, without forming the transverse projection and ridge of *Licmetis*. The basitemporal ridges run nearly continuously on to the paroccipital, and the surface external to them is inclined outwards. The shaft of the quadrate is very stout. In *Callocephalon* the two heads of the bone are only separated by a very narrow and shallow groove. In both genera the angle of the mandible is rounded and truncate.

In *Microglossa* the squamosal process fails to join, though it projects a little way under, the suborbital ring; it is exceedingly small and pointed. The posterior or postorbital region of the suborbital bar is very large and broad, and sends back a posterior lobe from its lower angle. The temporal fossa is very small, scarcely larger than in *C. roseicapilla* and much less than in *C. leadbeateri*. The auditory meatus is wide open, its aperture approximately oval. The paroccipital process is large; looked at from behind its posterior border is nearly vertical, but its angle projects somewhat posteriorly; it is very little hollowed within, and the jugular foramen is very small; the basitemporal ridges run almost uninterruptedly into the deeply compressed lower border of the paroccipital. The articular facets for the quadrate are separated by a well-marked groove, and are walled off from the tympanic cavity by a splinter of bone. The quadrate has two deeply separate heads, the inner one scarcely half the size of the outer; its other characters are those of the family; the extra facet below the quadrato-jugal cup is small and deeply marked. The angle of the shaft is short and bluntly pointed; the mandibular fenestra is obsolete. In the skull the inner wall of the orbit is scarcely perforate in front of the orbital foramen; the jugal bone is notably expanded at its anterior end.

The skull of *Calopsittacus* (fig. 17) is similar to that of the

Fig. 17.

Calopsittacus novæ-hollandiæ (enlarged).

Cockatoos in having the orbital bar completed by junction both with postorbital and with squamosal, which leave between a rather elongated supratemporal vacuity. The auditory meatus is narrower than in the Cockatoos, and its posterior and inferior notches are

well-marked. The quadrate articulation is scarcely separated in the dry skull from the tympanic cavity. The "suprameatal area" is rather large and faces outwards; it is in fact unusually conspicuous, though vastly less developed than in *Nestor*. The inner head of the quadrate is small, widely separate from the outer, and bent sharply inwards; the pterygoid condyle is imperfectly separate from the mandibular. In the mandible the marginal surface of articulation with the body of the quadrate is very conspicuous, and the edge of the mandible is here bent outwards. A small mandibular fontanelle is present; the angle of the jaw is short but pointed. As in Cockatoos generally, the interorbital vacuity is small and rounded. In one point, not among those chiefly considered in this paper, the skull of *Calopsittacus* differs from its congeners: between the anterior rami of the palatines there are visible (as in *Psittacus*) two long processes descending from the posterior portion of the maxillary bones; these are the "median processes of the inferior margin of the postaxial surface of the prosopium," in Dr. Mivart's description of *Psittacus*. They are, as a rule, small or obsolete in the other Cacatuidæ. It is clear that the skull of *Calopsittacus*, though at first sight very similar to, is different in several respects from, the true Cacatuine type. It is possible that these differences involve resemblances to the *Platycercini*, and this question will be further discussed below.

Family Nasiterninæ.

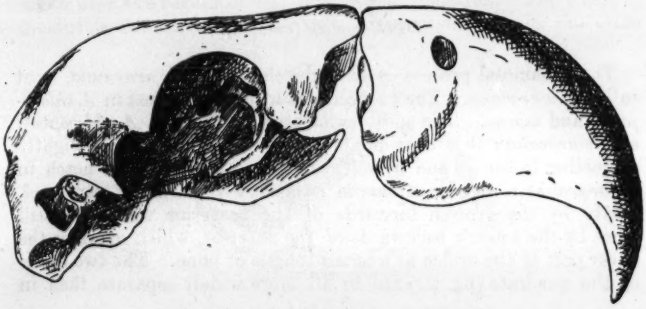
I have examined the tiny skull of *N. pygmæa* in an example unfortunately not full-grown, belonging to the Museum of the R. College of Surgeons. It is impossible to rest much weight on this beautiful but imperfect little skull. The orbit is exceedingly incomplete, the prefrontal process being very short (the prefrontal bone is not yet quite co-ossified with the frontal, and is in close connection for an almost equal extent of contact with the nasal). The postfrontal process is also small and scarcely prominent; the squamosal process, on the other hand, is long and slender and directed obliquely downwards. The posterior border of the auditory meatus is nearly straight. The suprameatal tubercle and its subjacent groove are both well marked.

The Macaws.

The great Blue Macaws differ, as is well known, from the rest in certain of their cranial characters. In *Anodorhynchus hyacinthinus* (fig. 18, p. 27) the orbit is incomplete, the prefrontal process terminating in a sharp point below the middle of the orbit. The postfrontal process is of moderate size, short but massive; the squamosal process is rather small, and united nearly to its tip on the inner side by a bridge of bone to the edge of the temporal fossa. The auditory meatus is wide and approximately square in outline; the posterior and superior recesses of the tympanic cavity are scarcely

excavated, and the partition between the cavity and the quadrate articulation is scarcely visible in the dry skull. The squamosal and proötic articular surfaces are both wide, and are separated by a deep groove, though in the quadrate bone itself there is but a shallow groove between the two heads. The shaft of the quadrate is longer and less massive than in the Cockatoos; the quadrato-jugal cup and the pterygoid condyle are both large; the anterior or orbital process is long and attenuated. The paroccipital wings are largely developed, and run almost uninterruptedly below into the basitemporal ridges. The posterior view of the skull is very similar to that of *Microglossa*. On the dorsal border of the foramen magnum can be detected two small articular facets: these are produced by contact with the unusually developed spine of the axis vertebra; in *Microglossa*, on the other hand, two small subordinate facets are present on either side of the occipital condyle.

Fig. 18.



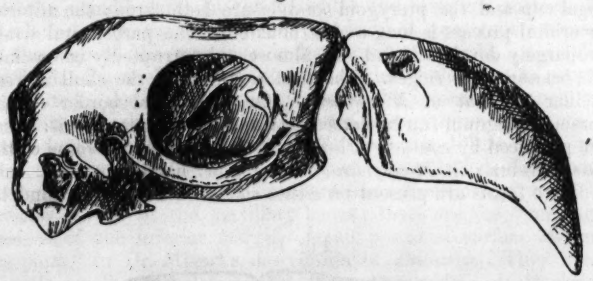
Anadorhynchus hyacinthinus (reduced).

In the Hyacinthine Macaw the anterior margin of the interorbital septum is deeply notched, the lower portion running forward like a curved and pointed blade. The anterior region of the cranium, on either side of the upper portion of the septum, is hollowed out into two immense and deep cavities, which are scarcely represented in the other Macaws; indeed, in this region, and on the corresponding opposite face of the "prosopium," there are many interesting characters to be recognized that lie beyond the scope of this paper. The jugal bone is compressed from above downwards at its anterior extremity, instead of from side to side as in *Microglossa*. The angle of the mandible is obtusely truncated; the ramus presents no mandibular fontanelle; the accessory marginal articulation for the quadrate is large, elongate, and connected by a smooth surface with the main articulation.

Of the other Macaws, I have examined *A. ararauna*, *chloroptera* (fig. 19, p. 28), *macao*, and *maracana*. That of *A. ararauna* is remarkable in having the orbital ring incomplete, though the long

curved prefrontal processes approach very close to the postfrontal; it is complete in the others, and its posterior portion is somewhat broad and flattened, especially so in *A. macao*, where the broadened hinder region forms an obtuse postero-inferior angle.

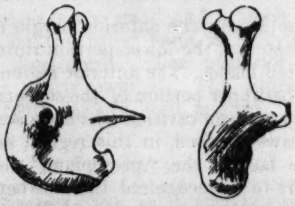
Fig. 19.



Ara chloroptera (reduced).

The squamosal process is least developed in *A. ararauna*, most so in *A. maracana*. The paroccipital wings are largest in *A. chloroptera* and *macao*. The auditory meatus is widest in *A. chloroptera* and *maracana*; it is considerably narrowed, and shows a slightly projecting lower lip and a well-marked postero-superior notch in *A. ararauna*; and in *A. macao* it is very remarkably narrowed, partly by the growth forwards of the posterior wall, and still more by the growth backwards of the anterior, which overlaps the lower part of the orifice as a broad tongue of bone. The two heads of the quadrate (fig. 20) are in all more widely separate than in

Fig. 20.



Quadrate bone of *Ara chloroptera*.

A. hyacinthinus. The anterior margin of the infraorbital septum is squarely truncate in *A. ararauna*; it tends in the others, and especially in *A. macao*, to curve forward in the same manner as, though in a less degree than, in *A. hyacinthinus*.

The mandible is narrowest from side to side in *A. ararauna*, and in this respect least like that of *A. hyacinthinus*. In the same species the articular groove for the quadrate is nearly straight

antero-posteriorly, while in the others, as in *A. hyacinthinus*, that of each side converges inwards: in the same species the angle is somewhat less truncated than in the others, and the facet for the insertion of the depressor muscle smaller, more rounded, and not ascending, as in the rest, on the posterior margin of the bone.

The Conures.

Excluding the Macaws, I have examined of the other Conuridæ, *Conurus*, *Pyrrhura*, *Myopsittacus*, and *Brotogerys*. The skulls of the first differ from those of the last two materially. In *Conurus* I have found the orbital ring complete in *C. leucotis*, but incomplete in *C. æruginosus* (fig. 21) and *C. hæmorrhous*: in both of the latter, however, the imperfection is but slight, the prefrontal process running backwards nearly to contact with the postfrontal. The squamosal process is somewhat stout, and curves forward in the direction of the orbital ring; its lower border forms a marked notch over the region of the quadrate articulation. The auditory meatus is considerably wider in *C. hæmorrhous* than in the other

Fig. 21.

Conurus æruginosus.

two species, and the upper and lower notches are accordingly better marked in the latter. The inner head of the quadrate is of considerable size; the anterior process is very slender; the posterior angle of the bone is reduced, and the articular surface runs up abruptly to end in a prominence on a level with the base of the shaft, making the outer surface of the bone appear narrower than usual; but this last character is much less marked in *C. hæmorrhous* than in the others. The paroccipital wings and basitemporal ridges are well developed. The supra-occipital is markedly tumid in the region of the middle lobe of the cerebellum. The mandible is extremely short and broad, and its fontanelles are obsolete. The descending processes from the hinder border of the maxilla are very well developed in *C. hæmorrhous*, but not so in the other two species.

In *Pyrrhura hæmatotis* the orbital ring is complete, as in *C. leucotis*, and the whole skull differs little from the latter species, except that a mandibular fontanelle is present and the interorbital vacuity is unusually large and rounded or less produced posteriorly.

In *Brotogerys* and *Myopsittacus* the orbit is incomplete, and the

postfrontal process is in both cases very small, while the squamosal one is of large size. The auditory meatus is narrow, especially in *Myopsittacus*. A mandibular foramen is present and large in *Brotogerys*, absent in the others; the ramus of the mandible is in both longer and its angle less truncated than in the Conures. The nares in *Brotogerys* are even larger than in the Conures, and separated by a very narrow bridge of bone; in *Myopsittacus*, on the other hand, they are unusually small and wide apart.

Family Pioninæ.

Of this group I have studied *Chrysotis æstiva* (fig. 22), *Pachynus brachyurus*, *Pionus menstruus* and *P. maximiliani*, *Caica melanocephala* (fig. 24, p. 31), and *Pœocephalus fuscicapillus* (fig. 26, p. 31). Of these, *Chrysotis* and *Pionus* are markedly different from the rest. In *Chrysotis* the orbital ring is complete, by the fusion of the pre-

Fig. 22.

Chrysotis æstiva.

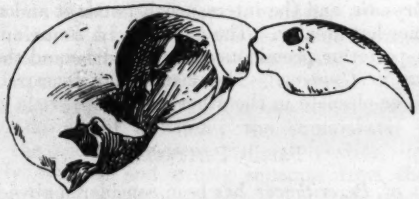
Fig. 23.

Quadrate bone of *Chrysotis æstiva.*

orbital and postorbital processes, and the bar thus formed is strong and broad, and forms with its lower border an abrupt descending angle opposite to the extremity of the squamosal processes, which closely approaches it. The latter is broad and massive, and similar in shape to that of *Conurus*; the temporal fossa between the postfrontal and squamosal processes is deep, but unusually narrow. The auditory meatus is wider, its superior and inferior notches are broad and rounded, and the ridge separating it from the quadrate articulation is low and indistinct. The proötic articular surface is

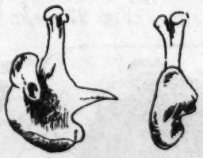
deep, the squamosal large but shallow. The paroccipital wings are continuous with the basitemporal ridges. The ridge running from the supra-occipital region to the outer and posterior margin of the paroccipital process, and separating the posterior from the lateral aspect of the skull, takes a somewhat sinuous course forwards behind the ear, so as to leave between it and the border of the meatus a much narrower interspace than in *Psittacus* and *Eclectus*; the same is true also of *Conurus*. The quadrate is very similar to that of *Conurus*. Descending processes are not present on the hinder border of the maxillæ. There is a small mandibular fenestra.

Fig. 24.



Caica melanocephala.

Fig. 25.



Quadrate bone of *Caica melanocephala.*

Fig. 26.

Pœocephalus fusciocapillus.

The skull of *Pionus* is very similar. The interspace between the auditory meatus and the occipital ridge is still narrower. A deeper notch separates the paroccipitals from the basitemporal ridges. The shaft of the quadrate is shorter and stouter, and the anterior process more reduced.

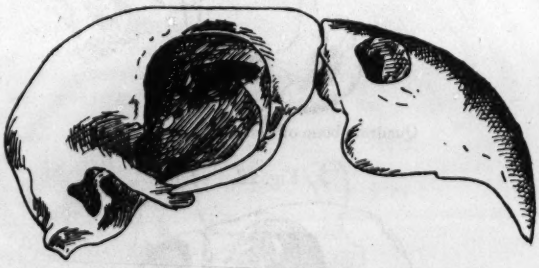
In *Pachynus*, *Caica*, and *Pœocephalus* the orbital ring is incom-

plete, and in all these the postfrontal process is extremely reduced, forming only a short protuberant edge as in *Eclectus*. In all the squamosal process is well developed: it is especially long and straight in *Pachynus*, in which it nearly meets the prefrontal; the latter process is much shorter in *Pœocephalus* than in the other two. In *Pachynus* the basitemporal ridges are faint, and the surfaces external to them and extending back to the paroccipitals are much flattened, the paroccipitals being directed backwards; there is no trace of descending maxillary processes. In *Caica* the basitemporal ridges are much stronger; in all the basitemporal plate is nearly on a level with the occipital condyle. The auditory meatus is somewhat narrower and more notched above and below than in *Chrysotis*, and the interspace between it and the occipital ridge is somewhat greater. The quadrate in *Caica* and *Pachynus* has a high posterior prominence above and behind the socket for the jugal, as in *Conurus*. The mandibular fenestra is large in *Caica*, small or obsolete in the other two.

Family Psittacinæ.

The skull of *Ps. erithacus* has been considered already. I have also studied the skulls of *Coracopsis vasa* (fig. 27) and *C. nigra*, and an imperfect specimen of *Dasyptilus pecqueti* (fig. 28).

Fig. 27.



Coracopsis vasa.

The skulls of these Parrots bring us face to face with the problem of whether *Coracopsis* and *Dasyptilus* are rightly placed in so close a relation to *Psittacus*; in other words, with one of the dubious and crucial questions that osteology might suffice to solve. I cannot boast of being able to give a very clear answer to the question, but it seems to me that the skull of *Dasyptilus*, and in a minor degree that also of *Coracopsis*, differs in so many points from that of *Psittacus*, that they go far to show that the little group of *Psittacinæ* is very dubiously or improperly defined.

In *Coracopsis vasa* the postfrontal process is almost obsolete, forming a slight vertical ridge behind which rises the impression of

the temporalis muscle. The squamosal process is broad, deeply notched at its base above the quadrate articulation, and the suprameatal process and the flattened or excavated surface in front of it are considerably developed. The auditory meatus is narrow and crescentic, its upper end forming a deep notch. While this notch approximates to the occipital ridge, lower down a broad surface lies between the latter and the meatus. The paroccipital process is extremely short and blunt. The nostrils are large, the mandibular fenestra very large, and the interorbital fenestra small.

The skull of *C. nigra* agrees in most points with that of *C. vasa*. But the paroccipitals are shorter, rounder, and more expanded; the triangle of the basitemporal plate is more obtuse, and it is less elevated from the level of the occipital condyle.

The mandible has in both species a very large fontanelle.

In *Psittacus* the postfrontal process is stout and prominent though short, the impression of the temporalis muscle elongated, but narrow from above downwards. The squamosal process straight and narrow, devoid of a notch; the suprameatal process ill developed; the auditory meatus moderately wide, its posterior border nearly straight and widely separate from the occipital ridge; the paroccipital process is prominent; the nostril and the interorbital fenestra are both of moderate size; the mandibular fenestra is small.

Of *Dasyptilus pecqueti* (fig. 28) I have only an imperfect skull, removed from a skin; but, as it is, it exhibits characters of con-

Fig. 28.

Imperfect skull of *Dasyptilus pecqueti*.

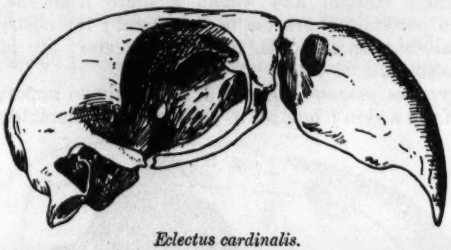
siderable interest. The orbit is incomplete, and the prefrontal process even less than in *Psittacus*. The postfrontal is small, and much as in the latter genus. The squamosal is extremely stout and broad, and bears an accessory process and notch on its lower border. The suprameatal tubercle is minute. The auditory meatus is nearly circular, and is surrounded by a strong ring of bone, produced below into a small notch or lip; there is no posterior or superior notch, and in front the ring of bone separates, in an unusually complete way, the auditory cavity from the

quadrate articulation. The outlines of the temporal and digastric fossæ are, as shown in the diagram, extremely different from those of both *Psittacus* and *Coracopsis*. The shaft of the quadrate is extremely stout, its inner border running down evenly into the mass of bone above the quadrato-jugal cup; the anterior process is short but stout; the inner head of the bone is of exceptional size. Alone among all the forms I have examined, the interorbital vacuity is completely absent. I feel convinced that further examination of better material will show *Dasyptilus* to be a very peculiar and isolated form. *Coracopsis* is very similar to *Eclectus*, and this resemblance will be discussed in dealing with the latter form.

Family Palæornithinæ.

Of the forms grouped as Palæornithinæ, I have studied *Eclectus* (fig. 29), *Geoffroyus*, *Tanygnathus* (figs. 30, 31), *Polytelis* (fig. 32, p. 35), *Aprosmictus* (fig. 33, p. 35), *Pyrrhulopsis* (figs. 34, 35,

Fig. 29.



Eclectus cardinalis.

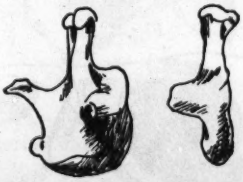
Fig. 30.

Tanygnathus megalorhynchus.

p. 36), *Agapornis* (fig. 36, p. 37), and *Palæornis*; I regret in particular the want of *Loriculus*. Of these, it is clear that *Polytelis*, *Aprosmictus*, and *Pyrrhulopsis* stand apart from the first

three; while *Agapornis* and *Palæornis* also have peculiar characters. The skulls of *Geoffroyus* and *Eclectus* are extremely alike, in all their leading features: they are, moreover, so similar to that of *Coracopsis*, that their descriptions may be abbreviated. They both have, as in *Coracopsis*, a prefrontal which reaches to, but does not join, the squamosal; a small postfrontal, somewhat larger, however, than in *Coracopsis* and directed more forwards; a raised triangular basitemporal shield, with broad smooth lateral areas

Fig. 31.



Quadrate bone of *Tanygnathus megalorhynchus*.

Fig. 32.

Polytelis barrabandi.

Fig. 33.

Aprosmictus cyanopygius.

reaching back to a sharp and nearly horizontal paramastoid: in both, the lower margin of the auditory meatus is deeply and narrowly notched, the upper and posterior angle somewhat square, especially in *Eclectus*; the temporal fossa narrow and deep. The mandibular fontanelle is distinct but not large.

Tanygnathus, while appertaining to the same type, exhibits numerous points of difference. The orbital ring is more widely

nterrupted; the postfrontal process is larger and arches downwards; the squamosal process is very stout, and its outer surface is practically continuous with that of the low, broad, suprameatal process. The auditory meatus is wide open and nearly square; the basitemporal plate is much smaller relatively, and scarcely larger actually than in *Geoffroyus*; and the surfaces lateral to it are correspondingly broad. The two heads of the quadrate are confluent; the anterior or pterygoid process of the same bone is unusually large. The mandibular fontanelle is obsolete. The intraorbital fissures are unusually small.

Fig. 34.

Pyrrhulopsis personata.

Fig. 35.

Auditory region of *Pyrrhulopsis*.

Pyrrhulopsis, *Aprosmictus*, and *Polytelis* differ from *Tanygnathus* in several points, and particularly in the region of the postorbital and squamosal processes. The postorbital is very indistinctly defined, and exists only as the thickened edge of the descending posterior rim of the orbit, where it meets the temporal fossa. It descends lower in *Aprosmictus* than in *Pyrrhulopsis*, and lower still in *Polytelis*, where it leaves only a slight and narrow groove between it and the squamosal to represent the outlet of the fossa. The configuration of the base of the squamosal process is totally different from that of *Tanygnathus*; for the suprameatal process is now separated by a wide and deep groove from the squamosal, and the latter does

not overhang the quadrate, but is excavated to form a deep notch, which exposes the head of the quadrate bone. In all these forms the intraorbital fissure is large, the descending processes from the hinder border of the maxillæ are large also, the inner head of the quadrate is quite distinct, and the mandibular fenestra is obsolete.

Fig. 36.

Agapornis roseicapillus.

In all, the auditory aperture is much narrowed, by the forward growth of the posterior wall of the meatus; this takes place to the greatest extent in *Polytelis* and *Aprosmictus*, in which last the aperture is reduced to a curved slit. The basitemporal triangle is very small in *Pyrrhulopsis*, and well defined from the areas at its sides; the paroccipital processes, looked at from behind, are nearly vertical; in *Aprosmictus* they are more horizontal, and the lateral areas are accordingly more on a level with and less defined from the basitemporal; in *Polytelis* the same tendency is still more displayed.

In *Agapornis* the orbital ring is incomplete and the postfrontal extremely small, as in the forms last described. There is a notch at the base of the squamosal process, but the latter is not separated by a groove from the suprameatal; the conformation here is more as in *Eclectus*. The auditory meatus is narrow, and the intraorbital vacuity very large. The mandibular fenestra is large also. The quadrate is very delicate in form; its two heads are fused, its shaft is very slender, and its anterior process small.

Family Platycercinæ.

Of this group I have examined skulls of *Platycercus* (fig. 37), *Nanodes* (*Lathamus*) *discolor*, *Neophema pulchella*, *Psephotus*, *Nymphi-*

Fig. 37.

Platycercus elegans.

cus (figs. 38, 39), and *Melopsittacus* (fig. 40, p. 39). Of these, the last alone differs markedly from the others. The characters common to the rest are precisely the characters to which I have called attention in *Aprosmictus*, *Polytelis*, and *Pyrrhulopsis*; that is to say, to the Australasian forms described under the group *Palæornithinæ*. In all, we find an incomplete orbital ring, a postfrontal process scarcely represented by more than the raised border of the orbit; a squamosal process crossed at its base by a deep groove above the meatus and in front of the suprameatal process. In all, the auditory meatus is narrow and curved; the intraorbital vacuity is large (especially in *Nymphicus*); the mandibular fenestra is obsolete. In all, the base of the skull is flattened, the small tri-

Fig. 38.

Nymphicus uvæensis.

Fig. 39.

Auditory region of *Nymphicus uvæensis* (enlarged).

angular basitemporal plate being nearly on a level with the areas at its sides. The squamosal region presents certain peculiarities in the several forms. In *Platycercus*, at least in Pennant's Parrakeet, the groove above described at the base of the squamosal is bridged by a well-developed ring of bone, extending from the suprameatal process to a slight descending process or tubercle at the base of the squamosal. In *Nymphicus* the groove is extremely deep, and though the bridge of bone is not present, the two processes are very well marked, that at the base of the squamosal being extremely conspicuous. In *Neophema* the postfrontal process is at a minimum, the posterior border of the orbit running with

scarce a perceptible interruption on to the upper border of the squamosal. In *Nymphicus*, the inner head of the quadrate is ill-defined; in *Platycercus* it is separate but very small: in both the shaft is slender, the anterior process very small, and the pterygoid condyle scarcely separate from the mandibular.

Fig. 40.

Melopsittacus undulatus.

In *Melopsittacus* we have a complete orbit, and furthermore a bridge of bone crosses the temporal fossa, uniting the postfrontal process to the squamosal, precisely as in the Cockatoos, though leaving a proportionately small fenestra. The characters of the base of the squamosal region, of the base of the skull, of the intraorbital vacuity, and of the mandible resemble those of the other *Platycercinæ*. The quadrate is very like that of *Nymphicus*. In the hyoid of *Melopsittacus*, by the way, the parahyal processes form an arch, meeting together above the basihyal, precisely as Dr. Mivart has shown in the case of the Lories.

Recapitulation.

From the foregoing facts it seems to me easy to draw certain interesting conclusions, though many questions are still left imperfectly answered. In the first place, the isolation of *Nestor* is very evident. The whole character of the squamosal and auditory region of the skull is unique, and unapproached in any other Parrot. The great size of the intraorbital vacuity and of the mandibular fenestra, the shape of the quadrate, as well as the more obvious peculiarities in the shape of the beak and mandible, all distinguish the skull at a glance. There is no osteological ground for allying *Nestor* with the Lories as in Dr. Gadow's scheme, any more than with *Psittacus* and *Ara* as in Garrod's. Its right to constitute a separate family as instituted by Salvadori seems perfectly clear, and indeed Prof. Newton (Dict. of Birds, p. 629) has already remarked that Salvadori's view "is fully justified by a cursory examination of its osteology."

Though less striking at a glance, the cranial peculiarities of *Stringops* are certainly no less important. I am inclined to attach high importance to the characters of the quadrate bone, in which, as I have shown above, the short thick shaft, the large broad anterior process, the great ridge bearing the jugal cup, and the position of the pterygoid condyle, widely separate from the mandibular articular surface, are all unique among the Parrots, in all the

rest of which the quadrate, varying within narrow limits, has a form very characteristic of and peculiar to the family. I have no doubt that, in respect to the other Psittaci, this quadrate of *Stringops* is a primitive one—that is to say, it is not to be conceived as formed by a further modification of the typical Parrot's quadrate, but has less of modification than theirs; but at the same time it possesses, though in an ill-formed way, the Psittacine characters, and I cannot draw from it any clue to relationship outside the group. Of all the characters of the Psittacine quadrate, the chief is found in the character of the articulation with the mandible, and the region of this articulation deserves a little further consideration.

It is a characteristic of all Birds that this articulation is a double one. In Reptiles the transversely expanded lower end of the quadrate is crossed by a saddle-shaped groove, and so forms an outer and inner tuberosity, which, however, form one articular surface, playing on an uneven but continuous socket in the articular and sometimes extending outwards on to the angular bone. But in Birds the corresponding groove is deepened, until the condyle, originally single, is divided into two: the inner one lies below and behind the articulation of the quadrate with the pterygoid, the outer one below and internal to the articulation with the jugal (the main difference in the Reptile lying in the extension of that portion of the quadrate intervening between the inner part of the condyle and the pterygoid). The former plays into the deep glenoid cavity, more or less elongated in an antero-posterior direction, on the inner side of the jaw; the latter plays on a no less well-marked surface on the outer margin of the jaw. In *Apteryx* we see these two very clearly, and they are both remarkable for their transverse form and position, with a minimum of antero-posterior elongation. In *Struthio* we find the outer, or (for convenience) the sub-jugal condyle, produced backwards into a well-marked and somewhat hollowed articular surface immediately below the shaft of the bone, and these two portions play into an enlarged area along the outer border of the mandible, quite distinct from the inner or true glenoid cavity.

In the Raven the state of matters is not dissimilar, but the outer articulation, as it were increasing in importance, now, in its posterior extension, runs backward very nearly to the posterior angle of the jaw. In *Dacelo* this posterior portion of the outer condyle is developed into a separate tubercle little less than the anterior one, and the facet on the mandible is divided into two portions accordingly. With various slight modifications, a similar condition is found in very many other birds, and in the Herons we reach an extreme development of the posterior (and outer) condyle, now separated by a deep hollow (to which, in the mandible, a high ridge corresponds) from the anterior portion. The more this posterior area becomes enlarged and separated from the anterior, the more in certain cases it becomes approximated to the inner (or sub-pterygoid) condyle, though, so far as I can see, the corresponding surfaces in the mandible remain distinct. Thus both in the Herons, in some Raptores (*e. g.* the Condor), in the Gulls, and also in *Dacelo*,

in a greater or less degree, the two areas become connected, with less or more interruption, by a definite ridge.

Now in the Parrots the inner or sub-pterygoid condyle becomes so extremely enlarged and so elongated from before backwards, that at first sight it appears to form the entire articulation. With its antero-posterior extension it has also undergone a downward expansion, while the region of the bone below the jugal cup is not only thereby raised far above the level of the inner (or true) condyle, but at the same time becomes much less prominent in the outward or lateral direction. This is one of the respects in which *Stringops* seems to have undergone less modification than the others, for the region bearing the jugal cup is very prominent laterally and less raised than in the others above the level of the main condyle. We have seen that more or less in all Parrots the edge of the mandible plays upon the side of the quadrate below the jugal cup, and we now recognize that this is not a new and fortuitous contact, but a more or less obsolete survival of what in Birds in general is one-half of the primitive articulation.

In the Cockatoos, especially in *Microglossa*, and in the Macaws, this articular facet below the jugal cup is quite distinct, and in *Stringops* it is also well-marked and points downwards; in *Microglossa*, where the jugal region of the quadrate is also prominent, though less so, it likewise looks more or less downwards, while in the Macaws and others it lies on a more nearly vertical slope.

It is more difficult to determine how or to what extent *the posterior extension* of this outer condyle, that we have seen to be so well-marked in many birds, is represented in the Parrots. We might be inclined to imagine, from the manner in which it sometimes comes, as I have described above, to approximate with the inner condyle, that the large size of the latter in the Parrots was due to a fusion of the two; but the absence of any change in the relations of the corresponding cavity in the mandible forbids me to think so. I take it that this portion of the quadrate is still represented by that region of the bone immediately behind the pterygoid cup which, reduced or truncated in most Parrots, is comparatively prominent in *Stringops*. And although this area no longer serves an articular purpose, I think we may recognize it (both in its more highly developed form in *Stringops*, and in the shape of a smaller tubercle in *Ara* and *Microglossa* and of an elevated protuberance in *Conurus* &c.) by its relations to the quadrato-jugal cup, behind which it lies, and to the region bearing the main condyle which curves evenly backwards towards it.

I have already shown that in its complete orbit, formed by a junction of the prefrontal and postfrontal elements, *Stringops* is unique among the Old-World Parrots; its temporal fossa is disproportionately large compared with all the rest; the grooved surface posterior to the squamoso-temporal articulation and overhung by the suprameatal process is by far more developed than in any other Parrot except *Nestor*, though in this respect *Stringops* itself is far from approaching that peculiar type, and such resemblance as this

region shows does not amount to an indication of affinity between the two outlying forms. On the whole, the facts in our possession seem to confirm the right of both genera to represent separate families very distinct from the other Psittaci, and there is more evidence in the skull of *Stringops* than in that of *Nestor* of low or primitive characters. In spite of its complete orbit I am inclined to think it the lowest or least modified of a highly modified group, and to look upon *Nestor* as an aberrant but less primitive form, to which, however, I cannot assign a direct connection with, or derivation from, any other known genus.

The Cockatoos are for the most part distinguished by a complete orbit, and by the fusion of the suborbital bar both with the postfrontal and with the squamosal process, so that a bridge is formed across the temporal fossa (*cf.* Garrod, P. Z. S. 1874, p. 594); where the temporal fossa is incompletely bridged, as in *Microglossa* and in *Cacatua ducorpsii*, a posterior ramus extends backwards, apparently from the postfrontal part of the suborbital bar, to bridge it incompletely. The shaft of the quadrate is stout, the region bearing the jugal cup is elevated, and the external or subjugal articular surface comparatively well-marked. The interorbital septum is deep and truncated or indented anteriorly. The auditory meatus is on the whole wide, and its posterior border is always very near to the occipital ridge. The external nares are round, and comparatively small, sometimes, as in *Microglossa*, very small indeed.

Calopsittacus is, in the character of its orbital ring, thoroughly Cacatuine; but it differs in its larger and more oval nostrils, and in a greater narrowing of the auditory meatus by reason of the ingrowth of its posterior wall, which leads to an extension of the interspace between the meatus and the occipital ridge. *Cacatua roseicapilla* forms in both respects an intermediate stage.

The only other Parrot in which the temporal fossa is bridged by bone, so far as I know, is *Melopsittacus*, though here the squamosal process is much broader and flatter, and the temporal fossa much smaller than in *Calopsittacus*. The two skulls, however, show a strong resemblance one to another.

With the exception of *Melopsittacus*, the whole group of Australian Parrots united under the name *Platycercinæ* agree, so far as I have examined them (and I particularly regret the want of *Pezoporus* and *Geopsittacus*), in several distinctive characters. The Australian genera *Polytelis*, *Aprosmictus*, and *Pyrrhulopsis* (and I expect *Ptistes* also) agree so perfectly in cranial characters with the *Platycercinæ*, that I do not doubt for a moment the necessity of removing them from the *Palæornithinæ* and uniting them with the other Australian genera. The leading character in all these forms is the presence of a deep groove or excavation at the base of the squamosal process, the area overhung by the suprameatal process being confluent with the temporal fossa. The auditory cavity is clearly bounded in front and separated from the region of the quadrate articulation by a bar of bone confluent above with this region in front of the suprameatal process. There is further a

well-marked notch on the lower margin of the squamosal process at the place of the quadrate articulation, much as in *Stringops*. The auditory meatus is very narrow and crescentic in form; the space between it and the descending occipital ridge is very wide; the basitemporal region is nearly on a level with the occipital condyle; the paroccipital process is blunt (except in *Pyrrhulopsis*); the orbital ring is incomplete and the postfrontal process almost obsolete or represented only by a vertical ridge; the nostril is large, the interorbital fenestra is moderately so, the mandibular fenestra is extremely small or obsolete. While *Melopsittacus* appears to differ most markedly from the above in its complete orbital ring, with its bridge, as in the Cockatoos, across the temporal fossa, yet at the same time it possesses an extremely well-marked notch at the base of the squamosal and a deeply-excavated surface between this and the suprameatal tubercle; it agrees in all the other characters mentioned above with the *Platycercinæ*, of which I have no doubt it is a real, though a somewhat aberrant, member.

The case of *Calopsittacus* is a little more difficult. While in the Cockatoos the auditory meatus reaches backward to the descending occipital ridge, in *Calopsittacus* as in *Melopsittacus* there is a wide interspace between. The auditory meatus is proportionately narrower than in the Cockatoos. The temporal fossa, though bridged by bone as in the Cockatoos, is much smaller and narrower than in them. There is a very distinct notch at the base of the squamosal and a well-marked surface between it and the suprameatal process, though this is not nearly so conspicuous a feature as in the *Platycercinæ*. The nostrils are very large and near together as in *Melopsittacus*, and are very different from the small, round, and distant nostrils of the Cockatoos. On the whole I should say that, so far as cranial osteology goes, the position of *Calopsittacus* is an open question, and that it is by no means impossible that it may really deserve to be grouped somewhere near *Nymphicus* and *Melopsittacus*. While the facts suggest at least the possibility of a closer affinity than that usually recognized between the two Australian groups of *Cacatuinæ* and *Platycercinæ*, this larger question must also remain for the meantime in uncertainty.

The true Lories form a natural group, and their place is, I believe, not far from the *Platycercinæ*. The auditory meatus is constricted, its posterior border is crescentic and widely separated from the occipital ridge. The orbit is incomplete and the postfrontal process almost obsolete or (as in *Eos*) narrow and vertical. The squamosal process is more or less distinctly notched at its base, more in *Lorius*, much less in *Trichoglossus*, and the well-marked suprameatal process overhangs a surface of bone, to which ascends, as in *Aprosmictus* &c., the bar which separates the auditory cavity from the region of the quadrate articulation. The excavated region of the base of the squamosal is not nearly so complete as in the *Platycercinæ*, but yet it is more like to them than to any other family of Parrots.

The three genera grouped by Salvadori as *Psittacinæ*, namely

Psittacus, *Coracopsis*, and *Dasyptilus*, are very different from one another in regard to their skulls. *Coracopsis* appears to show a marked resemblance to *Eclectus* and *Geoffroyus*. As to *Dasyptilus*, it is certainly very different from both *Coracopsis* and *Psittacus*: the characters of our imperfect specimen suggest no close alliance with other forms, but go some way to indicate a very isolated position for the genus.

The skull of *Agapornis* differs very materially from that of the typical *Palæornithinæ*. The difference is, in the first place, conspicuous in the extremely narrow auditory meatus and extremely wide, almost square, surface between its straight posterior border and the descending occipital ridge. The suprameatal tubercle is moderately developed, the squamosal process long and curved, the postfrontal process extremely small, the nostrils and the interorbital and mandibular fenestræ all large. It is for one thing plain, from the breadth of its post-auditory region, that *Agapornis* differs greatly from the ordinary South-American Parrots. I regret that I have not been able to examine the skull of *Psittacula*, for it would be extremely interesting to see whether this osteological feature confirms (like the characters of the carotids) the separation of these two superficially similar but geographically distinct genera.

Extremely different from all the Parrots of the Old World and very similar to one another are the two genera *Chrysotis* and *Pionus*. The orbit is complete by junction of the prefrontal and postfrontal processes, and the bridge of bone so formed descends to form an angular prominence opposite the extremity of the squamosal. The temporal fossa is extremely narrow. The inferior border of the squamosal is curved but not notched. The suprameatal tubercle is low, the auditory aperture wide, and its posterior border is very near to the occipital ridge which bends forward in a sinuous curve to approach it. The paroccipital processes are prominent but flattened or excavated below externally to the basitemporal ridges. The nostrils are of moderate size, the interorbital fenestræ small, and the mandibular fenestra nearly obsolete. Of the genera grouped with these by Salvadori under the name *Pioninæ*, I find *Pachynus*, *Caica*, and the African *Pœocephalus* to be very different. *Caica*, in the extremely small size, circular form, and wide distance apart of its nostrils, resembles *Myopsittacus*, which latter is usually grouped with the Conures. In their other characters *Caica* and *Myopsittacus* are very similar to one another. The postfrontal process is short and nearly vertical, especially in *Caica*. The squamosal process is curved in its lower border and more or less distinctly notched at its base. The suprameatal tubercle is distinct, the auditory meatus rather wide and its posterior border somewhat further from the occipital ridge than in *Chrysotis* and much farther than in *Conurus*. The paroccipital process is very much as in *Chrysotis*; the long prefrontal process much as in *Conurus*. The interorbital fenestra is of moderate size;

the mandibular fenestra differs in the two genera, being obsolete in *Myopsittacus*, but large in *Caica*.

In *Conurus* and *Pyrrhura* the orbit is sometimes complete, though the suborbital bar when complete is slender; when it is incomplete the postfrontal process is long, as long or nearly so as the squamosal and very much longer than in any of the Old-World Parrots. The squamosal process is curved below but indistinctly notched, the suprameatal process is extremely small, the auditory meatus is uncommonly wide and its posterior border is very near to the occipital ridge. The paroccipital processes are prominent and more vertical than in *Chrysotis*. The nostrils are of moderate size, rounded, and somewhat distant, being intermediate in all three respects between *Chrysotis* and *Myopsittacus*. The interorbital vacuity is considerably larger than in *Chrysotis* or *Pionus*. The mandibular fenestra is variable, sometimes large and sometimes obsolete.

There remain to be considered a small number of genera between which I find it harder to draw osteological distinctions or to trace definite resemblances to those already considered. These forms include *Palæornis*, *Tanygnathus*, *Eclectus*, and *Geoffroyus*—in other words, the remaining genera of the so-called *Palæornithinæ* after removing from that family *Agapornis* and the Australian genera allied to *Aprosmictus*; and also *Pachynus* and *Brotogerys*, at present grouped respectively with the *Pioninæ* and the *Conurinæ*, *Pœocephalus*, the African genus grouped with the otherwise exclusively South-American *Pioninæ*, and *Coracopsis*, associated by Salvadori with *Psittacus*. The above genera have all an incomplete orbit and an extremely small postfrontal process in the shape of a more or less vertical ridge. The prefrontal process is long, and it extends close to, though it is not united with, the tip of the long straight squamosal process. The auditory meatus is comparatively wide; the area between it and the occipital ridge is broader than in *Conurus* or *Chrysotis*, but narrower than in *Psittacus* or the Lories, and *à fortiori* much narrower than in *Agapornis*. There is no notch below (except in *Coracopsis*) nor groove across the base of the squamosal process.

The skulls of *Palæornis* and *Tanygnathus* are extremely alike, the only conspicuous difference being in the nostrils, which in *Tanygnathus* are smaller and wider apart. In both genera the interorbital vacuity is extremely small and similar in character. In *Eclectus* the interorbital vacuity is moderately large, the squamosal process is expanded towards its tip, the nostrils are small and oval with the long axis of the oval vertical, and the descending occipital ridge is faintly marked (whereas in the others it was extremely strong) and curves forwards, giving a distinctly different outline to the post-auditory area in front of it. In *Geoffroyus*, with no very important differences perhaps from *Eclectus*, there is less identity of characters than we should expect to find from the very close association in which it is customary to place the two genera.

The nostrils are much larger even than in *Palæornis* and as near together, the interorbital vacuity is large, the squamosal is not expanded distally, the temporal fossa is small, the auditory meatus is narrower, and the post-auditory area broader than in any of these other three genera of *Palæornithinæ*.

The skull of *Pachynus* differs from that of *Chrysotis* and *Pionus* (between which it is placed by Salvadori) in its incomplete orbit and its extremely rudimentary postorbital process. The squamosal process is straighter and narrower, and the post-auditory area somewhat broader.

Brotogerys likewise differs from *Conurus* in its larger and more approximate nostrils, its very small postorbital process, and its more expanded post-auditory area.

The skull of *Pœocephalus* has large nostrils, a small postorbital process, a straight, rather short, squamosal. It certainly differs in these respects from its supposed ally *Caica*. The post-auditory region is extremely tumid, and the crescentic border of the meatus forms a deep notch above. I am unable to draw from the cranial characters of this genus any clear inference as to its closer relationships.

3. Report on the Gorgonacean Corals collected by Mr. J. Stanley Gardiner at Funafuti. By Isa L. Hiles, B.Sc. (Vict.), Owens College, Manchester.[1]

[Received November 2, 1898.]

(Plates I.–IV.)

Of the forms of Gorgonacean Corals sent to me by Mr. Gardiner for identification and examination the majority belong to the family Muriceidæ.

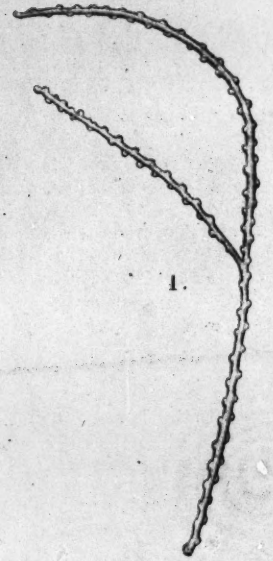
There is one Gorgonellid—*Verrucella granifera* Kölliker; two Sclerogorgic forms of Gorgonidæ—*Suberogorgia verriculata* Esper, and *Keræides koreni* Wright & Studer; and one Plexaurid, *Euplexaura antipathes* Klunzinger.

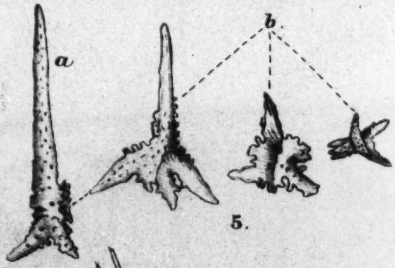
Among the representatives of the Muriceidæ there are three new forms—*Villogorgia rubra*, *Acamptogorgia spinosa*, and *Muricello flexilis*.

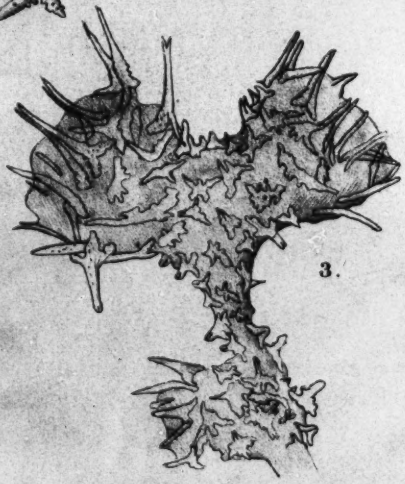
The specimens have been very carefully preserved in spirit, but unfortunately in some cases the endoderm is not complete, and therefore they are not so useful for anatomical examination as they would otherwise be.

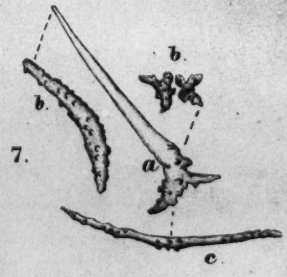
I am much indebted to Professor Hickson for the great help he has given me, especially with regard to the literature. The classification adopted is that used by Wright and Studer in the 'Challenger' Report on Alcyonaria.

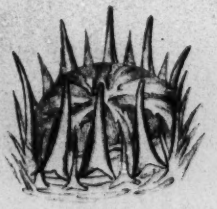
[1] Communicated by Prof. Sydney J. Hickson, F.R.S., F.Z.S.











J.Smit lith. Mintern Bros. imp.

FIGS.1,2.VERRUCELLA GRANIFERA. FIGS.3-5.ACAMPTOGORGIA SPINOSA.
FIGS.6,7.ACANTHOGORGIA MURICATA.

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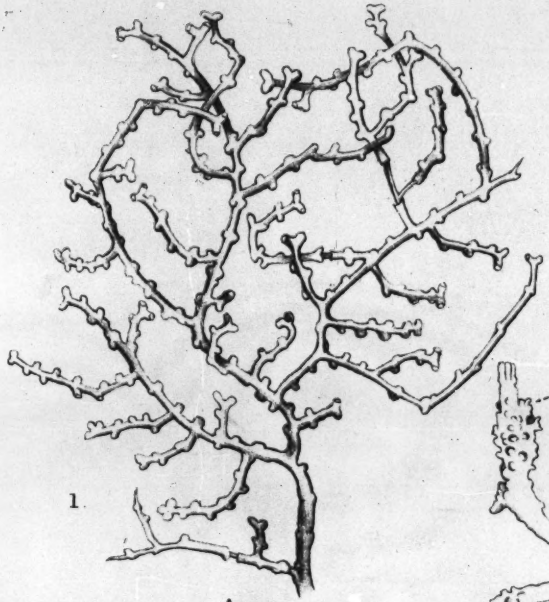

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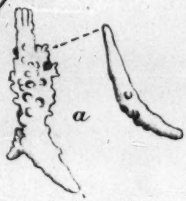

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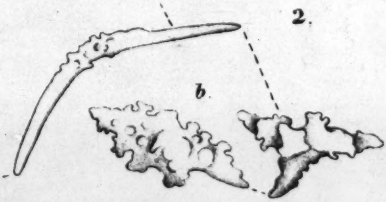

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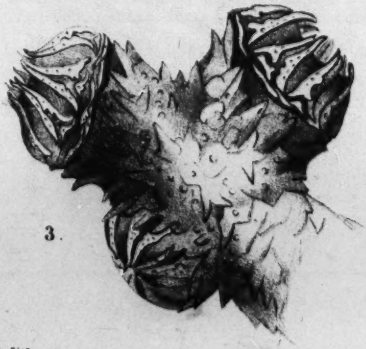

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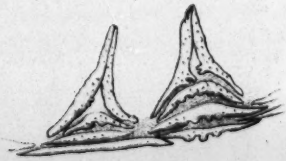

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VILLOGORGIA RUBRA.

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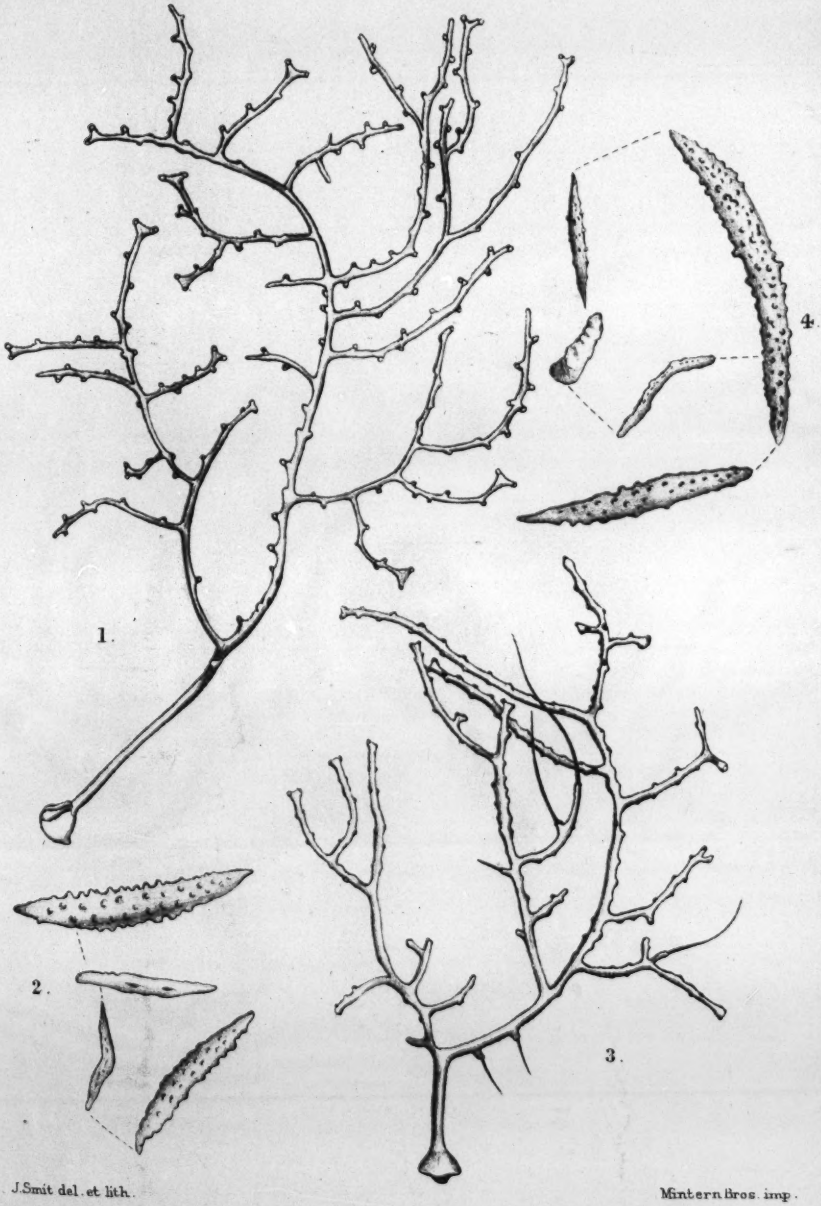

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Figs. 1,2. MURICELLA FLEXILIS. Figs. 3,4. M. TENERA.

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Mintern Bros imp.

EUPLEXAURA ANTIPATHES

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Section Scleraxonia.

Family Sclerogorgidæ.

Kerœides koreni Wright & Studer.

There are numerous fragments of this species, but no complete colony.

The spicules are ·92 mm.–·203 mm. in length, by ·27 mm.–·13 mm.

The colony is light red in colour, with yellow polyps.

Hab. Outer slope of the reef. Depth 40–90 fathoms.

Previously recorded from the neighbourhood of Japan (7).

Section Holaxonia.

Family Muriceidæ.

Acamptogorgia spinosa, n. sp. (Plate I. figs. 3, 4, 5.)

There are several fragments of this form, but they are all rather small.

The branches are ·5 mm. in diameter. The cœnenchyma is fairly thick and very rough. The small branches arise at angles of from 60°–90°. The polyps are borne chiefly on the sides of the branches. They stand out fairly perpendicularly at intervals of about 2 mm.

Each branch bears, close to the apex, two opposite polyps which are usually somewhat larger than the others. They are 1·05 mm. in height, by 1·1 mm. across the crown and ·64 mm. across the base.

The other polyps are ·73 mm. × ·62 mm., and ·55 mm. across the base. Thus the terminal polyps are decidedly larger than the lateral ones. They are cylindrical in shape, somewhat wider across the crown.

The operculum forms a low cone; it consists of the basal spicules of the tentacles, each tentacle having 2 or 3 long pointed spicules which divide into two at the basal end. They are ·36 mm. × ·09 mm. (length by breadth), and rest on a sunken collaret of spindles.

The polyp spicules are of the three-rayed type with foliaceous expansions from two of the three rays, the third standing perpendicular to the others like a long sharp spike. They are ·37 mm. in height by ·36 mm. across the foliaceous basal portion.

The cœnenchyma spicules are bent spindles with short branched expansions on the convex side, and also smaller forms of the polyp spicules. The spindles are ·21 mm. × ·11 mm. (length by breadth).

The axis is horny, brown, with the central core divided into chambers.

The colour of the colony in spirit is light brown.

Depth 40–90 fathoms.

This form differs form *A. arbuscula*, *A. alternans* Wright & Studer, *A. acanthostoma* and *A. fruticosa* Germanos, in the structure of the polyps, their proportionate size to the width of the branch, and the shapes of the spicules. The spicules resemble most closely those of *A. acanthostoma*, but the polyps of the new species are much more spiny.

ACANTHOGORGIA MURICATA Verrill. (Plate I. figs. 6, 7.)

Verrill (4) gives no figures, but the specimen agrees fairly with his description of the species.

The branching is in one plane.

Height of the specimen 75 mm.; breadth 8 mm.; diameter at the base 1 mm.

Length of the calyces 2·0–2·5 mm.; diameter at the base ·6 mm.; diameter of the head 1·2 mm.

The spicules round the edge of the calyx are 1·01 × ·06 mm.; the spicules of the calyx-wall are ·75 × ·03 mm.; the spicules of the cœnenchyma are ·3 × ·03 mm. Most of the spicules are crooked, and some have the smaller end slightly branched.

Depth 40–90 fathoms.

Previously recorded from Barbados; depth 76 fathoms.

This is a good example of wide distribution, the same species being found at Barbados and at Funafuti, two widely separated localities.

VILLOGORGIA INTRICATA Gray.

There is one example of this species attached to the axis of a dead Gorgonid. Wright and Studer (7) describe the species among the 'Challenger' Gorgonidæ.

Depth 40–71 fathoms.

Previously recorded from a locality between the Fiji Islands and the New Hebrides. Depth 145 fathoms.

This is a considerable difference in depth, but the specimen is undoubtedly *V. intricata*.

VILLOGORGIA RUBRA, n. sp. (Plate II. figs. 1, 2, 3, 4.)

There are two small colonies with much of the cœnenchyma rubbed off.

The basal attachment is present in both as a small, flat, calcareous expansion.

One colony gives off a broken branch at an angle of 90°, 10 mm. above the base; the main stem reaches a height of 40 mm., and 13 mm. from the apex gives off another branch at the same side, 8 mm. long.

The other colony is 34 mm. high and gives off three branches fairly perpendicularly. These are all on the same side; the lowest arises 11 mm. from the base and is broken off short; the second is 9 mm. long, and arises 3 mm. above the first; the third is 4·5 mm. above the second, and is 13 mm. long.

There are very few polyps, most of the cœnenchyma having

been rubbed off; but what remains of the cœnenchyma is thin. The polyps arise almost perpendicularly, and mostly on the two sides. The end of a branch bears two polyps, one slightly in advance of the other, but neither truly terminal. The polyps are ·92 mm. in height by 1·3 mm. in breadth at the base.

The spicules of the cœnenchyma are chiefly four-rayed stars and flattened curved spindles, giving off spines from the convex side. They are ·12 mm. long by ·2 mm. broad.

The polyps are covered with broad flat spicules, somewhat triangular in shape, with branched lateral outgrowths. They are ·22 mm. × ·49 mm. (length by breadth).

The operculum is eight-rayed; each ray consists of two broadish spicules, converging at the apex. Their bases rest on a horizontally placed spicule, curved in shape and somewhat spiny. The opercular spicules are ·31 mm. × ·07 mm.

The axis is horny, flexible, with the centre divided into chambers.

The colour of the colony in spirit is reddish brown. The spicules of the cœnenchyma and polyps are bright red, those of the operculum white.

Hab. Outer slope of Ellice Island. Depth 40–71 fathoms.

This form differs from *V. intricata* Gray in the size of the polyps and of the spicules, the arrangement of the polyps, and the colour of the spicules.

It differs from *V. mauritiensis* Ridley (**5**) in the size of the polyps, the shape of the spicules of the verrucæ, and the colour of the colony.

It differs from *V. flabellata* Whitelegge (**9**) in the colour and form of the spicules.

It differs from *V. nigrescens* Duchassaing & Michelotti (**1**) in the form and size of the verrucæ and in the colour of the colony.

MURICELLA FLEXILIS, n. sp. (Plate III. figs. 1, 2.)

There is one small specimen of this form. It is 130 mm. in height and 70 mm. across the widest part. The main stem is 1·5 mm. in diameter near the base.

Branching takes place in one plane, the branching arising from two sides of the stem. Lateral branches are borne in the same plane. The branches are slightly flattened in the plane of branching; they all end in a small flat expansion with two lateral polyps borne close to the apex, making it somewhat hammer-shaped.

The calyces are ·9 mm. by ·8 mm. in diameter at the base. The polyps are only partially retracted, the heads, measuring ·6 mm. × ·5 mm. in diameter, being visible above the verrucæ.

The spicules are spindle-shaped, with warts not very thickly placed. They are 1·105 mm. × ·09 mm., ·83 mm. × ·073 mm., ·18 mm. × ·027 mm.

The colour in spirit is dirty white, the brown axis showing through the thin white cœnenchyma.

Hab. Outer slope of the reef of Funafuti. Depth 40–71 fathoms.

This specimen differs from *M. tenera* Ridley (**5**) in the greater

slenderness of stem and branches, the smaller size of the spicules, and the fact that they are much less warted.

It differs from *M. umbraticoides* Studer[1] in the absence of the "halbseitig warzig" character of the spicules.

It differs from *M. complanata* Wright & Studer (7) in its much more slender appearance, the thinness of the cœnenchyma, and the comparatively smooth character of the spindles, and also in colour being white, not rose-colour.

It differs from *M. perramosa* Ridley (5) in colour and in the absence of a divergent bend of the stem at the origin of the branches.

It differs from *M. nitida* Verrill (4) in colour, in the size of the spicules, and the lateral position of the polyps.

It differs from *M. gracilis* Wright & Studer (7) in the lateral arrangement of the polyps at the ends of the branches, in the much less warted spindles, and in the colour of the cœnenchyma, which is not red but white.

It differs from *M. crassa* Wright & Studer (7) in the thinness of the cœnenchyma, the lateral arrangement of the polyps, the slender character of the stem and branches, and in the much smoother character of the spicules.

MURICELLA TENERA Ridley. (Plate III. figs. 3, 4.)

There is one colony; it is 115 mm. high by 55 mm. across the widest part. The main stem is 2 mm. in diameter at the base. It is ramified in one plane, giving off branches on two sides at angles of about 45°; these again bear branches at angles of 45°–60°.

The calyces are small and inconspicuous, ·5 mm. high and 1 mm. in diameter at the base. They are borne on the two sides of the stem and branches about 2 mm. apart.

The branches end in two laterally placed polyps, making the termination triangular in shape.

The cœnenchyma is thin and whitish in colour; the brown axis shows through, making the whole appear fawn-colour. The polyps are brown.

The spicules are long, wavy spindles, covered with warts, which are more prominent on one side than the other. They are 4·34 mm. × ·29 mm., 2·34 mm. × ·22 mm., ·29 mm. × ·036 mm.

Hab. Outer slope of the reef. Depth 40–71 fathoms. This specimen differs slightly from *Muricella tenera* as described by Ridley (5), but the differences are not very important. The calyces are smaller, and the spicules are from two to four times the size of those of Ridley's form.

The spicules of the calyx also are not arranged in such a regular row as Ridley figures; Wright and Studer (7. p. 124) say the same about these spicules in the forms examined by them.

Otherwise the colony decidedly approaches *M. tenera*: I have

[1] Studer, Th., Monatsber. d. k. Akad. d. Wiss. Berlin, 1878.

seen the 'Challenger' specimen, and consider this to be the same form.

Previously recorded from south of Papua, off the Ki Islands, depth 140 fathoms; and Port Molle, Queensland.

Family PLEXAURIDÆ.

EUPLEXAURA ANTIPATHES Klunzinger. (Plate IV. figs. 1, 2.)

Plexaura antipathes Klunzinger.

This specimen, which is in a dried state, is pale fawn in colour.

The colony is much branched, the branches arising approximately in one plane. The branches are given off irregularly; they, in their turn, branch repeatedly, and these branches bear further branches. There are no traces of anastomoses. The basal portions are slightly flattened, but the terminal twigs are round and thicken slightly towards the ends. The branches run close together and fairly parallel.

The polyp-pores are scattered irregularly over the whole surface, and are not raised above the general level except on the terminal twigs, where they are at the summit of slight conical elevations. They are about 1 mm. apart.

The cortex is friable, and somewhat thicker on the twigs than the older parts. It is comparatively smooth; on the older branches there are slight longitudinal furrows which run somewhat spirally round the stem. The axis is of horn, with scattered particles of calcareous matter; it is of a dense black colour in the thicker branches.

The "root" portion of the colony shows a great development of a peculiar skeletal substance, hard, and looking like stone. It is dull grey in colour, and shows the same furrowings as the cortex of the stem which extended over it. On treating with acid the stony part is dissolved away, leaving a fine network of horny matter in which the $CaCO_3$ was contained.

The grey substance which strengthens the base of attachment is clearly formed independently of the black axis, although it may rightly be regarded as being of the same nature. Judging from the dried specimen it is composed of spicules of lime embedded in a horny matrix, no processes of the cœnosarcal canals extending into it, even superficially. It is extremely hard, and breaks with a clean fracture when struck with a hammer. The horny axis, on the other hand, can be cut with a penknife. The nature of the horny substance is not determined, but from its insolubility seems similar to the keratin of the axis. It is only rarely seen in specimens of Gorgonacea in Museums, although it is possible that it may be formed at the base of all large Gorgonids when exposed to strong tides.

In the centre the calcareous matter is white and friable, not having assumed the stony, solid appearance of the outer part.

The basal enlargement is seen also in *Plexaura principalis* and *P. suffruticosa*, in the National Collection at South Kensington;

and Klunzinger, in his 'Korallthiere des Rothen Meeres,' mentions it for *Plexaura antipathes*.

The spicules of the cortex are small warty spindles and clubs, the spindles preponderating. They are colourless, and are ·17 mm. in length by ·07 mm. in breadth. There are also a few small irregular crosses.

Hab. Funafuti Lagoon. Depth 6–7 fathoms.

Family Gorgonellidæ.

Verrucella granifera Kölliker. (Plate I. figs. 1, 2.)

Syn. *Verrucella flabellata* Whitelegge.

There are several fragments of this species. The largest is 170 mm. long; the stem is 1 mm. in diameter at the base, and remains about the same throughout. At a height of 70 mm. it gives off a branch, and 50 mm. farther another branch arises. The branches are about the same thickness as the stem. The whole is whip-like and very flexible.

The verrucæ are numerous, alternate, nearly at right angles to the axis, and about 2 mm. apart. They are ·5 mm. high by 1 mm. wide at the base, and bluntly conical in shape.

The axis is very hard and brittle; it shows a number of longitudinal grooves.

The branches end in a small knob, with a laterally-placed polyp close to the apex. The spicules are double stars and spindles of the Gorgonellid type. The warts are compound, and arranged in rings, leaving a median zone free and smooth. The spindles are flat, and many of them have rounded ends. The double spindles are ·073 mm. × ·036 mm., ·082 mm. × 018 mm.; the double stars are ·036 mm. × ·018 mm.

The colour, in spirit, is pale fawn.

These specimens seem to approach most closely to *Verrucella granifera* Kölliker (2), except that the spicules are only faintly tinged with yellow.

V. flabellata Whitelegge (9) seems to resemble Kölliker's form, *V. granifera*, very closely, the only difference, apparently, being that some of the spicules have rounded ends; but others, as he figures (pl. xvii. fig. 33), have pointed ends, and resemble those of *V. granifera*. This seems a small difference on which to found a new species, especially when the character is not constant and found in all the spicules. In one of the pieces from Funafuti which I examined the spicules are decidedly longer and more pointed than in the other fragments, although in other respects they are similar. This may be due simply to a difference in locality. A slight variety of form and size in the spicules is of frequent occurrence in Gorgonacea, and must not be considered of specific value.

Hab. Funafuti. Depth 40–71 fathoms. Previously recorded from the coast of Africa.

This is another instance of the same species from two widely

separated localities, and may be compared with the distribution of *Acanthogorgia muricata* Verrill, which occurs at Funafuti and has been recorded from Barbados.

SUBERGORGIA VERRICULATA Esper.

There are two fragments of this species, drab in colour.

The double-star spindles are somewhat rougher than those figured in Kölliker's paper (2), otherwise the form seems to belong to Esper's species.

Hab. Outer slope of the coral-reef at Funafuti.

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EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. *Verrucella granifera*, p. 52. A branch, natural size.
2. *Verrucella granifera*. Some spicules.
3. *Acamptogorgia spinosa*, n. sp., p. 47. A small portion of a branch, magnified, to show the arrangement of the spicules.
4. *Acamptogorgia spinosa*. The crown of a polyp, magnified, to show the arrangement of the opercular spicules.
5. *Acamptogorgia spinosa*. Some spicules, (*a*) of the operculum, (*b*) of the cœnenchyma.
6. *Acanthogorgia muricata*, p. 48. A polyp, magnified.
7. *Acanthogorgia muricata*. Some spicules, (*a*) of the operculum, (*b*) of the cœnenchyma, (*c*) of the polyp.

PLATE II.

Fig. 1. *Villogorgia rubra*, n. sp., p. 48. The colony, natural size.
2. *Villogorgia rubra*. Some spicules, (*a*) of the operculum, (*b*) of the polyp, (*c*) of the cœnenchyma.
3. *Villogorgia rubra*. Three polyps, magnified, to show the operculum closed.
4. *Villogorgia rubra*. Two rays of the operculum.

PLATE III.

Fig. 1. *Muricella flexilis*, n. sp., p. 49. The colony, natural size.
2. *Muricella flexilis*. Some spicules.
3. *Muricella tenera*, p. 50. The colony, natural size.
4. *Muricella tenera*. Some spicules.

PLATE IV.

Fig. 1. *Euplexaura antipathes*, p. 51. The lower part of the colony, × 1, to show the stony basal enlargement.
2. *Euplexaura antipathes*. A small portion of a microscopical section of the basal part, decalcified, showing the horny matrix.

4. Notes on a Collection of Gephyrean Worms formed at Christmas Island (Indian Ocean) by Mr. C. W. Andrews.

By ARTHUR E. SHIPLEY, Fellow and Tutor of Christ's College, Cambridge, and University Lecturer in the Advanced Morphology of the Invertebrata.

[Received December 3, 1898.]

The small collection of Gephyrea gathered by Mr. C. W. Andrews at Christmas Island (Indian Ocean), which, owing to the kindness of Professor F. Jeffrey Bell, I have been able to examine, contains one species of Echiurid and five of Sipunculid worms. No species is new, but, as I have pointed out in another place[1], the part of the world whence this collection comes has been carefully searched for Gephyrea, and the two chief authorities on the Sipunculoidea treat of specimens from this region of the earth; so that an absence of undescribed species is what might have been expected.

Together with this collection came a small bottle labelled "Queen Charlotte's Island, B.C., Rev. J. N. Keen." This contained four specimens of a Sipunculid that I recognize as *Physcosoma japonicum* Grube[2]. This species has hitherto been known from Northern Japan, Hakodate, Enosima, and from the coast of Australia. It has not hitherto, so far as I know, been found on the east side of the Pacific, and Mr. Keen's discovery of it on the American coast materially increases its range.

[1] Zoological Results etc. Willey, Cambridge, pt. ii. 1898, p. 151.
[2] Selenka, Die Sipunculiden, Wiesbaden, 1883, p. 76.

Echiuroidea.

Thalassema Gaertner.

1. Th. baronii Greef.

Greef, SB. Ges. Naturw. Marburg, 4 July, 1872, p. 106; 4 May, 1877, p. 68; and Acta Ac. German. vol. xli. pt. ii. p. 1.

Selenka, Gephyrea, 'Challenger' Report, vol. xiii. pt. xxxvi. p. 1.

Fischer, Abh. Ver. Hamburg, vol. xiii. 1895, p. 1.

A single specimen of this species represented the Echiurids in Mr. Andrews's collection. At first sight I took the animal to be an example of Fischer's species *Th. pellucidum*, which he remarks has certain resemblances with *Th. baronii*. It was about the same size as Fischer's examples, and the colour, which may have been altered by spirit, was similar to that of the young spirit examples of *Th. pellucidum*. Fischer states that in the older specimens the colour is bluish, and it is possible that the green tinge with its violet stripes which Greef describes in *Th. baronii* are only acquired with age. On the other hand, the specimen described by Selenka in the 'Challenger' Report from Bahia had lost its colour.

There can be no doubt that this specimen was a young form; including the proboscis it was about 3 cm. long, whilst the adults of Greef attain four times this length.

The structures on which I chiefly based my identification were: (i) the two pairs of nephridia, found also in *Th. formosulum* and *Th. exilii*, where, however, there are eight bands of longitudinal muscles, and in *Th. pellucidum*, where there are thirteen; (ii) the form and shape of the "respiratory trees," which closely resemble those figured in Greef's monograph; (iii) the breaking up of the circular muscle-sheath into very fine and very numerous bands, clearly indicated by Greef in his fig. 64, plate vi.; and (iv) the number of longitudinal muscles, which is eighteen. This last point deserves some notice. In his systematic account of *Th. baronii*, Greef does not mention the number of strands of longitudinal muscle; indeed it was not until 1883 that Lampert drew attention to the importance of these structures in the determination of species. Greef, in his figure of the species in question, indicates sixteen bundles, but as the cut edges of the skin are inflected it is reasonable to suppose that a further bundle has been hidden on each side. By some unexplained error, Lampert[1] gives the number of longitudinal muscles as twenty-three; and this number has been copied by Rietsch into his 'Étude sur les Géphyriens armés ou Échiuriens'[2]. Fischer has recently re-investigated the original specimens of Greef and has found in them 18–19 muscles.

Locality. Greef found his examples amongst the lava blocks and stones at low tide at Arrecife on Lanzarote, one of the Canary

[1] Zeitschr. wiss. Zool. vol. xxxix. 1883, p. 334.

[2] Geneva, 1886, or Recueil Zoologique Suisse, vol. iii. p. 505.

Islands. Selenka's specimen was taken at Bahia, 7–20 fathoms; Mr. Andrews's at Christmas Island.

SIPUNCULOIDEA.

ASPIDOSIPHON Grube.

2. ASPIDOSIPHON FUSCUS Sluiter.

Sluiter, Natuurk. Tijdschr. Nederl. Ind., Bd. xli. 1881, p. 495.

Shipley, Zool. Results etc. Willey, Cambridge, pt. ii. 1898.

A single specimen from Christmas Island extends the range of this species. Dr. Willey collected it at Sandal Bay, Lifu, and Sluiter, who described the species, records it amongst the Malay Gephyrea, but unfortunately gives no more precise locality.

CLŒOSIPHON Grube.

3. CLŒOSIPHON ASPERGILLUM Quatrefages.

Quatrefages, Histoire Naturelle des Annélés, vol. ii. 1865, p. 605.

Grube, Jahresber. Schlesisch. Ges. 1867, p. 48.

Selenka, Die Sipunculiden, Wiesbaden, 1883, p. 126.

Fischer, Zoolog. Forschungsreisen in Australien, Semon, vol. v. 1896, p. 338.

Shipley, Zoological Results etc. Willey, Cambridge, pt. ii. 1898.

A single small specimen measuring some 2 cm. in length. Dr. W. Fischer has recently recorded it from Thursday Island, Samoa, whence it extends throughout the south-west Pacific and Indian Oceans.

PHYSCOSOMA [1] Selenka.

4. PHYSCOSOMA MICRODONTOTON Sluiter.

Sluiter, Natuurk. Tijdschr. Nederl. Ind., Bd. xlv. p. 506.

Shipley, P. Z. S. 1898, p. 471.

One specimen, which, like those collected by Mr. Stanley Gardiner at Funafuti and Rotuma, was very much longer than the examples described by Sluiter. He, however, found no reproductive organs, so that it is possible his form was immature and not fully grown. The characteristic long nephridia reaching to the posterior end of the body—also found in *Ph. pacificum*—are well marked.

5. PHYSCOSOMA SCOLOPS Selenka & de Man.

Selenka, Die Sipunculiden, Wiesbaden, 1883, p. 126.

Shipley, P. Z. S. 1898, p. 468.

Shipley, Zoological Results etc. Willey, Cambridge, pt. ii. 1898.

[1] Zool. Anz. vol. xx. 1897, p. 460.

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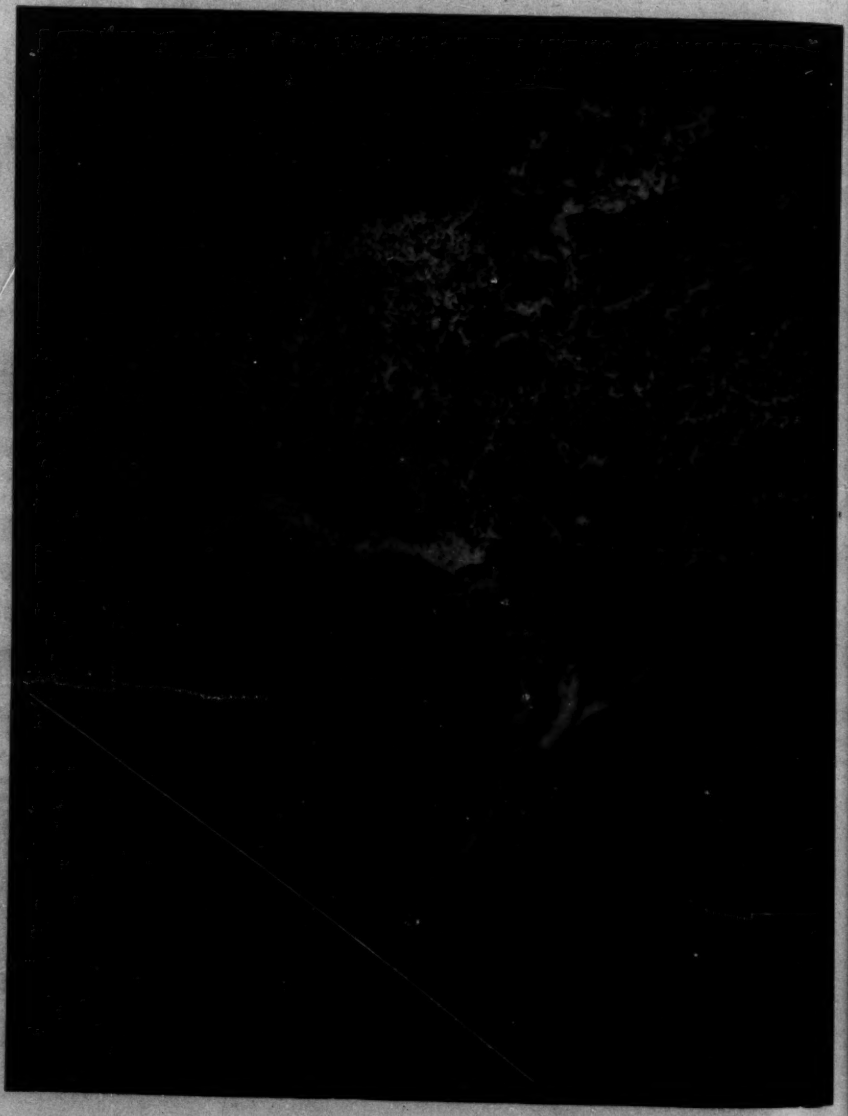

PLEUROCORALLIUM MADERENSE.

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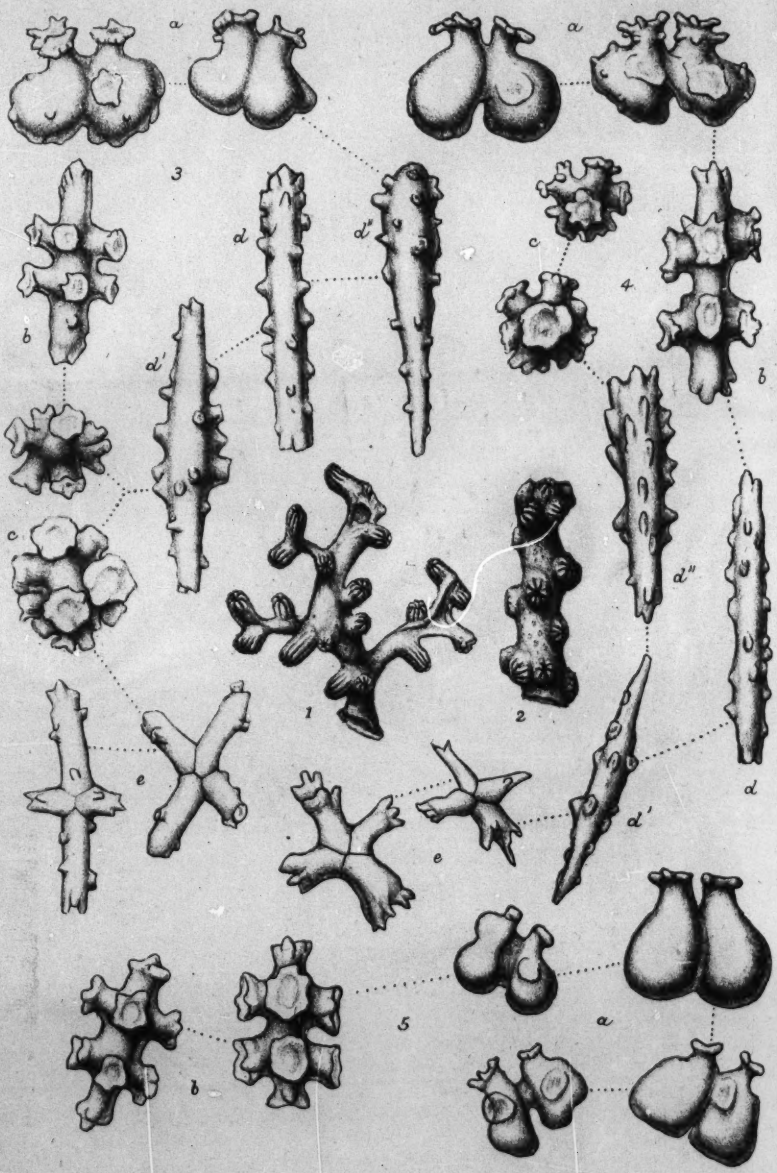

P. Highley del et lith. Hanhart imp.

Figs 1&4. PLEUROCORALLIUM MADERENSE.
Figs 2&5. P. JOHNSONI. Fig 3. P. TRICOLOR.

This species ranges from the Red Sea to the Loyalty Islands and Funafuti, and has also been found at Singapore, Amboyna, and the Philippines. Mr. Andrews's collection comprises three specimens. They all showed the reddish flesh-tint which Semper says characterizes the female when alive, the male being a dark brown.

SIPUNCULUS Linn.

6. SIPUNCULUS EDULIS Lamarck.

Lamarck, Animaux sans Vertèbres, 1st ed. vol. iii. p. 79.
Sluiter, Natuurk. Tijdschr. Nederl. Ind., Bd. xli. p. 148, Bd. xlv. p. 484.
Shipley, Zoological Results etc. Willey, Cambridge, pt. ii. 1898.

This species, which is eaten by the Chinese, is very variable in character and approaches *S. cumanensis* in many features. The two specimens collected at Christmas Island were of a decidedly pinkish hue, which faded at places into a greyish yellow.

5. Notes on the *Coralliidæ* of Madeira, with Descriptions of two new Species. By JAMES YATE JOHNSON, C.M.Z.S.

[Received December 3, 1898.]

(Plates V.–VII.)

Fam. CORALLIIDÆ.

Gen. PLEUROCORALLIUM Gray
(including *Hemicorallium* Gray).

The genus *Pleurocorallium* is distinguished from the genus *Corallium* by the following characteristics:—All the species branch in one plane; the prominent polype-cells are seated on one face of the branches; and a spicule shaped like a binocular opera-glass or like two carafes united at the sides is present in the cortical cœnenchyma.

Madeira appears to be the headquarters of this genus, three of the four known species being found there. The fourth species (*Pl. secundum* Dana) is doubtfully attributed to the Sandwich Islands, and its variety, *elatior* Ridley, to Japan.

There can be no doubt that the hard axis of these corals is capable of taking a polish, and might be worked up into ornamental articles having a commercial value if the corals occurred more abundantly. As it is, specimens are met with so rarely that the demands of museums of natural history cannot be supplied.

It may be remarked here that although the *Corallium rubrum* or *C. nobile* of authors is found in the Mediterranean, which is to the north of Madeira, and at the Cape Verd Islands, 900 miles to

the south, it has never yet been discovered at Madeira. But it is not impossible that the dredges of the Prince of Monaco may alight upon its lurking-place when his well-equipped exploring yacht comes to work over this part of the bed of the Atlantic.

1. PLEUROCORALLIUM TRICOLOR, sp. nov. (Plate VII. fig. 3.)

Branching subalternately in one plane to the fourth degree of subdivision; branches flexuose, not coalescing, elliptical in section, attenuating upwards, the ultimate branches slender and ending in points. Axis hard, white, its surface smooth. Cortex pale yellow, granulated. Polype-cells pale vermilion-red, very prominent, subpedicellate, ovoid or subconical, 2·5–3 millim. long, less

Pleurocorallium tricolor.

than 2 millim. in diameter. The upper part is divided into eight upright lobes standing round the orifice in a close circle. The cells are numerous and are irregularly scattered on the anterior face of the branches; the ultimate branchlets have usually two, sometimes three cells at their tips. (The cells are shown about $2\frac{1}{2}$ times the natural size in the accompanying figure to the left.)

The spicula of the cortex comprise three forms:—(1) Spicules shaped like an opera-glass or like two carafes joined at the sides and having two necks; the bodies are coarsely tuberculated and the ends of the necks are set with a cycle of conical tubercles. (2) Small, cylindrical, stout with two whorls, each of four thick rays, on the shaft at right angles thereto; the projecting ends of the shaft with the two whorls of rays make up a ten-rayed spicule; the ends of all the rays are tuberculated. (3) Numerous irregularly formed spicules which may be compared to balls with several thick rays: they seem allied to the last form, but neither axial shaft nor whorls of rays can be made out. In addition to these forms the polype-cells yield (4) numerous monaxile spicules about one and a half times the length of the spicule (2); some are cylindrical, others fusiform or clavate, and all are more or less tuberculated; (5) a few cruciform spicula varied in form and usually imperfect, but consisting essentially of four tapering arms at right angles to each other, their bases meeting at the centre with equal acute angles. (The spicula are figured on Plate VII. fig. 3.)

This species is less robust than the other two here described, so far as can be judged from the few known specimens. Three examples have been obtained at Madeira at different times, but for many years no others have occurred. The largest specimen was presented to the British Museum, and a second, smaller, but with perfect cells, was given to the Liverpool Museum. With these two specimens before him, Dr. Gray (P. Z. S. 1867, p. 126) assigned the latter to his *Hemicorallium johnsoni*, saying it was evidently the same species and showed the coral in its young state. His paper is illustrated by a good woodcut (here reproduced, see p. 58), which displays the entire specimen and the polype-cells. The cells are unfortunately very fragile, and drop off from the dry coral at the slightest touch or jar.

The specimen in the British Museum is without its base; it has a height of 170 millim. (6¾ in.) and the branches have a spread of about the same. The stem below the branches has a diameter of 6 millim. There are four principal branches, which in their lower parts vary in thickness from 4 to 7 millim.; above, they taper gradually and throw off tertiary and quaternary branchlets, which are seen to end in sharp points where stripped of the cortex. Two of the branches were quite dead long before the coral came from the sea, as was shown by the number of the plant-like polypiaries of hydroid zoophytes attached to them. The branches are often curiously perforated and tunnelled longitudinally on their anterior faces, and at these places are thicker than elsewhere. Boring animals appear to have attacked them, and it would seem as if fresh stony matter had been secreted so as to cover over the passages which are open at both ends, and the longer ones have usually a series of large openings at the sides. Sometimes a portion of the branch itself has been removed; at other places the stony axis does not appear to have suffered. One tunnel measured 35 millim. in length and had eleven openings at one side.

2. PLEUROCORALLIUM MADERENSE, sp. nov. (Plates V. & VII. figs. 1 & 4.)

Branching luxuriantly in one plane to the seventh or eighth degree of subdivision. Ramification close, dense. Branches irregularly flexuose, not anastomosing. The ultimate branches, when stripped of their cortex and cells, are seen to taper to a fine point.

The white axis is hard, compact, elliptical in transverse section, and its surface is smooth. The thin cortex is coloured a pale ochraceous yellow when the coral is fresh from the sea. Its surface is minutely papillate or granular. The polype-cells or calycles are very numerous and are all seated on the anterior aspect of the branches, mostly at their sides or at the tips of the ultimate branchlets. They are prominent, cylindrical, about 2 millim. long and 1 millim. in diameter. Their sides are marked with eight vertical ribs, and the mouths are surrounded by eight upright bundles of spicula forming an oval termination of the cell. The polypes have an orange colour.

Five forms of spicula are found in this species, viz.:—(1) numerous double carafes with two necks; (2) a few of the short two-whorled cylindrical rods or staves; (3) irregular rayed balls; (4) elongate, cylindrical, fusiform or clavate, tuberculated; (5) cruciform. All these agree more or less closely with the correspondingly numbered spicula of the preceding species. (See Plate VII. figs. 1 & 4.)

If the spicula alone were regarded, this species is more closely allied to the first than to the third species here described, but it is widely separated from the former by habit and coloration. From the following species, which agrees with it in coloration, it is distinguished by its much greater degree of ramification and the consequent greater density and delicacy of the branches; by the smooth, not striated surface of the hard axis under the cortex; by the form of the polype-cells, which are cylindrical, not hemispherical and wart-like; by the presence in the cortex of irregularly formed ball-like spicula and of a few cruciform spicula; and finally by the absence of the smooth form of double carafe spicule.

Only a single specimen of this very beautiful coral is known, and that was obtained so lately as the summer of this year (1898) by the Rev. Padre Ernesto Schmitz, late Director of the Episcopal Seminario, Funchal, from a fisherman who told him it had been brought up a few days previously by a fishing-line from deep water off Camara de Lobos, a village six miles to the west of Funchal. The specimen has been placed in the Museum of the Seminario, and a short description of it will now be given[1].

The base is wanting, the stem having been broken away from it. The height of what remains is 30 centim., or about 12 inches,

[1] For copies of the photographs of the entire corals from which the illustrations on Plates V. & VI. have been taken, I am greatly indebted to the kindness of the Rev. Padre Ernesto Schmitz, the founder of the Seminario Museum, Funchal, and for many years its indefatigable curator.

and the spread of the branches is nearly the same. The ramification is so dense that the coral resembles the thickly-leafed branch of a tree. In several places one layer of branches stands in front of another layer, but in both cases the polype-cells are on the anterior faces of the branches. The longer axis of the broken end of the stem measures 17 millim. There are three main branches, one of which has been broken off short, and this gives the coral a lopsided appearance. Here and there the main branches widen out in an irregular manner. This may probably be owing to the fact that boring animals have excavated the axis at these places, for in the lower part of the stem such excavations are seen where the spiculiferous cœnenchyma has been removed.

Upon the specimen were seated some interesting zoophytes that rarely occur at Madeira—(1) a branched Alcyonarian (probably *Suberia* sp.), 100 millim. high with a spread of 80; (2) four fine specimens of a *Desmophyllum*; (3) an example of the rare *Stenella imbricata* (J. Y. J.), 50 millim. high, with three or four branches.

3. PLEUROCORALLIUM JOHNSONI (Gray). (Plates VI. & VII. figs. 2 & 5.)

Since this species was shortly described by Dr. Gray as a member of the genus *Corallium* (P. Z. S. 1860, p. 127) from a specimen sent by me to the British Museum, larger and more perfect examples have occurred which supply materials for a completer account of it. In an Additional Note on this coral (P. Z. S. 1867, p. 125) Dr. Gray proposed two new genera, *Pleurocorallium* and *Hemicorallium*, assigning the present species to the latter. Later naturalists, not being able to find grounds for two genera, have abandoned one of them and placed the then single species of *Hemicorallium* under *Pleurocorallium*, as the definition of this genus in the Note cited preceded that of the other one. (See Stuart O. Ridley's valuable paper on the arrangement of the Coralliidæ, P. Z. S. 1882, p. 222.)

When fully grown, the coral is much and very irregularly branched with an open system of ramification, the flexuous branches extending essentially in one plane, rarely meeting and uniting. Base spreading widely and thinly over the object to which it is attached. Axis compact, stony, white, the surface striated longitudinally; its transverse section elliptical. Cortex (cœnenchyma) cream-coloured, frequently pitted; at the inner surface a ring of ducts (cœnosarcal canals) surrounds the axis. Polype-cells prominent, sessile, wart-like, subhemispherical, about 2 millim. high and 2·5 in diameter; irregularly scattered on the anterior face of the branches from 1 to 5 millim. apart, sometimes in contact, especially at the tips of the branches, which are knobbed with them. The summits have a cycle of eight short lobes, which in the dry state curve over the orifice. The polype has an orange or yellow colour.

Only three forms of spicula have been detected in the cortex and polype-cells:—(1) the double carafe-shaped spicule with two

necks, already described as being found in both the preceding species; (2) the short, stout, cylindrical spicule with two whorls of four rays, the "octoradiate spiculi" of Ridley, also present in the cortex of the two foregoing species, but here the latter is more regular and symmetrical; (3) a form bearing a general resemblance to (1), but with the united bodies more elongate, and each member pear-shaped or poke-like and smooth. This form is peculiar to the present species. (See Plate VII. figs. 2 & 5.)

This species occurs very rarely, but it is met with rather more frequently than any of the others. Only five specimens are known to me, the largest of which, as well as the one first discovered, were presented to the British Museum. The former of these has a height of 210 millim. (8 in.) and a spread of 315 millim. (12 in.). The stem, before it begins to throw off branches, has a thickness of 27 millim. Fortunately the base came up with the rest; it is a thin plate measuring 83 by 70 millim. There are four principal branches, which are again divided and subdivided in an irregular manner. At one part there are three overlapping layers of branches and in another two overlapping layers, but no instance of two branches meeting and uniting.

Another fine specimen in an excellent state of preservation was secured by the Rev. Padre Schmitz for the Seminario Museum, Funchal. It has the same height as the preceding but is not so wide by 50 mm. The coral is curved from side to side, so that the polype-bearing face is convex and the other face concave. The base has been left behind, the stem having given way at a place where it had been much perforated by boring animals. The section here measures 22 millim. by 18. There are five main branches, the longer axes of which measure from 10 to 15 millim. On the posterior side three secondary branches strike off from main branches at angles which are more than right angles above and consequently less below. The specimen is figured on Plate VI.

A third, much smaller specimen is in my possession. The underside of the spreading base, 55 millim. by 40, the longer axis being nearly parallel with the plane of the branches, is flat with a smooth surface, and bears impressions of three species of creeping bryozoa that had settled upon the supporting body before the coral grew over them. I have also one valve of the great sessile cirripede, *Pachylasma giganteum* (Phil.), measuring 36 millim. by 22, the exterior of which is completely coated with the cœnenchyma of the coral, and this has thrown up several polype-cells, but has not secreted a stony basis. This shows that the polypes secrete the hard compact axis simply as a support for the increasing colony.

In M. H. Filhol's work on the submarine explorations of the 'Talisman' (1884), he says that at the Cape Verd Islands, "entre 500 et 600 mètres nous avons rencontré une forme d'alcyonaire extrêmement intéressante au point de vue zoologique, appelée par M. Marion *Coralliopsis perieri*. Elle rappelle beaucoup le *Corallium secundum* de Dana vivant aux îles Fidji." This may have been an example of *Pleurocorallium johnsoni*.

Key to the four known species of Pleurocorallium.

I. Axis partly red, partly white, cortex scarlet.
secundum (Dana). "Sandwich Isl."?
Var. *elatior* Ridley. "Japan"?

II. Axis wholly white, cortex yellow or cream-colour.
(1) Polype-cells yellow or cream-colour.
(*a*) Polype-cells subhemispherical; only 3 forms of spicula.
johnsoni (Gray). Madeira.
(*b*) Polype-cells cylindrical; more than 3 forms of spicula.
maderense J. Y. J. Madeira.
(2) Polype-cells vermilion ..... *tricolor* J. Y. J. Madeira.

References.

Pleurocorallium tricolor.

1867. Gray, J. E. (*Hemicorallium johnsoni*). "Additional Note on *Corallium johnsoni*." P. Z. S. 1867, p. 126, with a woodcut.

1882. Ridley, Stuart O. "On the Arrangement of the Coralliidæ." P. Z. S. 1882, p. 226.

Pleurocorallium johnsoni.

1860. Gray, J. E. (*Corallium*). "Notices of some new Corals from Madeira." P. Z. S. 1860, p. 394, Radiata, pl. xviii. Ann & Mag. Nat. Hist. ser. 6, vol. iii. p. 311.

1867. Gray, J. E. (*Hemicorallium*). "Additional Note on *Corallium johnsoni*." P. Z. S. 1867, p. 126.

1870. Gray, J. E. (*Hemicorallium*). Catalogue of Lithophytes or Stony Corals in the British Museum, p. 24.

1882. Ridley, Stuart O. (*Pleurocorallium*). "On the Arrangement of the Coralliidæ, with Descriptions of new or rare Species." P. Z. S. 1882, p. 221, pl. ix.

EXPLANATION OF THE PLATES.

Plate V.

Pleurocorallium maderense, p. 60, about ⅔ nat. size.—The object projecting at the top of the fig. is the parasitic Alcyonarian, "probably a *Suberia*" mentioned on p. 61. From a photograph.

Plate VI.

Pleurocorallium johnsoni, p. 61, about ⅔ nat. size. From a photograph.

Plate VII.

Fig. 1. *Pleurocorallium maderense*, p. 60, terminal branchlets with polype-cells. × 2.
2. *Pleurocorallium johnsoni*, p. 61, a terminal branch with polype-cells. × 2.
3. *Pleurocorallium tricolor*, p. 58: *a*, *b*, *c*, spicula of the cortex; *d*, *d'*, *d''*, spicula from the polype-cells. × 400.
4. *Pleurocorallium maderense*, p. 60: *a*, *b*, *c*, spicula of the cortex; *d*, *d'*, *d''*, *e*, spicula from the polype-cells. × 400.
5. *Pleurocorallium johnsoni*, p. 61, spicula of cortex and polype-cells: *a*, spicule no. 3; *bb*, spicule no. 1; *c*, spicule no. 2, described on p. 62. × 400.

February 7th, 1899.

Prof. G. B. Howes, LL.D., F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of January 1899:—

The registered additions to the Society's Menagerie during the month of January were 71 in number. Of these 22 were acquired by presentation, 26 by purchase, 2 in exchange, 6 were born in the Gardens, and 15 were received on deposit. The total number of departures during the same period, by death and removals, was 96.

Amongst the additions attention may be called to the fine young male of the Argali Sheep (*Ovis ammon*) (Plate VIII.), received on deposit on January 18th, believed to be the first example of this species that has reached England. The Council hope to be able to acquire this animal, if it continues to do well, for the Society's collection. The animal at the present time stands about 29 inches high at the shoulders.

A communication was read from Mr. E. N. Buxton, F.Z.S., giving an account of a recent visit which he had made to the Forest of Bielovege in Lithuania, in order to see the Bisons (*Bison europæus*) in the Emperor of Russia's forest, where he was successful in approaching near enough to a part of the herd to obtain some photographs of these animals, which were exhibited to the Meeting.

Mr. Buxton was hospitably received by Col. Kolokalzoff, who is responsible for the forest, and by General Popoff, the Guardian of the Emperor's palace by whom he was housed in the building in which the Imperial guests are entertained. He described his journey through the forest as follows:—

"In the company of Mr. Neverli, the chief forester, I drove through many miles of the forest on the following day. It occupies a country which is almost dead flat, but is intersected by a few sluggish streams. With the exception of the meadows which border the latter, and a few clearances for cultivation round small villages, there are no open spaces: consequently, although the timber, which consists mainly of oak, elm, birch, spruce, and fir, is very fine, the forest is tame and wanting in variety. This monotony is enhanced by the unfortunate practice of removing all windfalls, a most short-sighted policy, as I think, because nothing so assists the warmth, shelter, and sense of security of a forest, for wild animals, as fallen timber, through the branches of which a tangle of wild growth quickly penetrates and forms a natural screen. The artificial effect is further increased by an immense extent of grass rides, which are cut in perfectly straight lines, at right angles to one another, dividing the forest into squares of

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four kilometres for the convenience of driving the game. There are nearly four hundred lineal kilometres of these rides.

"Mr. Neverli estimates the herd of Bisons at the present time at about seven hundred, and he puts the Elk, which frequent the wettest parts, at the same number. The wild Boars, judging by their frequent rootings, must be very numerous. Red deer were not formerly found in the forest, but have been introduced. I could not find out that there was any satisfactory basis for Mr. Neverli's calculation of the numbers of the herd of Bisons. Judging by the number of tracks which I saw, I am inclined to be sceptical of it. Every naturalist will be anxious to know whether the herd is diminishing or not. Mr. Neverli is of opinion that the herd was formerly more numerous, but such estimates may be based on some calculation even less authoritative than those of the present time.[1] The privilege of hunting in this forest was confined for centuries to the Kings of Poland exclusively."

The following papers were read :—

1. A Contribution to our Knowledge of the Cerebral Convolutions of the Gorilla. By Frank E. Beddard, M.A., F.R.S.

[Received February 7, 1899.]

From a valuable summary of the literature relating to the Gorilla, contributed to 'Natural Science' by Dr. Keith, it appears that no more than twelve brains of this Anthropoid Ape have been submitted to examination. Of these at least that of which some account has been given in the 'Transactions' of this Society by Sir R. Owen was in so poor a state of preservation that not much of value can be deduced from the data.

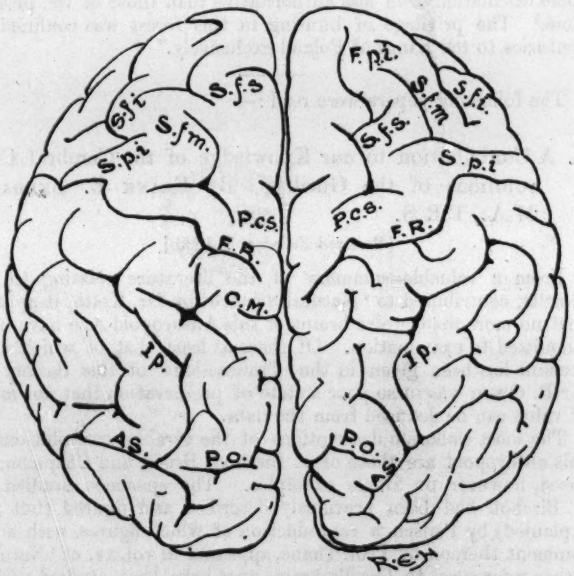
The most elaborate descriptions of the cerebral convolutions of this anthropoid are those of v. Bischoff, Broca, and Chapman, all based, however, on single examples. The specimen studied by v. Bischoff had been previously described and figured (but not explained) by Pansch, a reproduction of which figures, with some comment thereon by Prof. Thane, appeared in vol. xv. of 'Nature.' Other references to Gorilla brains that have been studied will be found in the list of literature with which I conclude the present communication. Some doubt was thrown by v. Bischoff upon the genuineness (as a Gorilla's brain) of the specimen described by Broca; Chapman, however, held that it was certainly a Gorilla's brain, and I associate myself with him in this expression of opinion. All (?) the Gorillas' brains existing in Germany at the time—most, if not all, of which had been previously studied by himself and by Pansch—were brought together and subjected to a

[1] Herr E. Büchner (Mém. Acad. Imp. Sci. St. Pétersb. (8) iii. no. 2) states that the herd in 1856 numbered nearly 1900, and expresses his opinion that the diminution is caused by "breeding-in."

renewed study by v. Bischoff in 1882. There were five brains, but the paper dealing with them was by no means exhaustive, only touching upon certain regions.

This being the state of our existing knowledge of the brain of the Gorilla, I have thought that it would not be a work of supererogation to bring before the Society some notes upon five Gorillas' brains which I have in my possession at the present time. None of these brains have formed the basis of any previous description, so that my contribution to the subject is so far absolutely new. Furthermore, the extent to which the Gorilla's brain has been adequately illustrated is very small: in

Fig. 1.



Brain of Gorilla belonging to Royal College of Surgeons. Dorsal view.

As. Simian fissure. *C.M.* Calloso-marginal. *S.f.s.* Frontalis superior. *S.f.m.* Frontalis medius. *F.p.i.* Part of frontalis superior. *P.o.* Parieto-occipital. *F.R.* Fissure of Rolando. *S.p.i.* Præcentralis inferior. *Ip.* Interparietal. *P.c.s.* Præcentralis superior. *S.f.i.* Frontalis inferior.

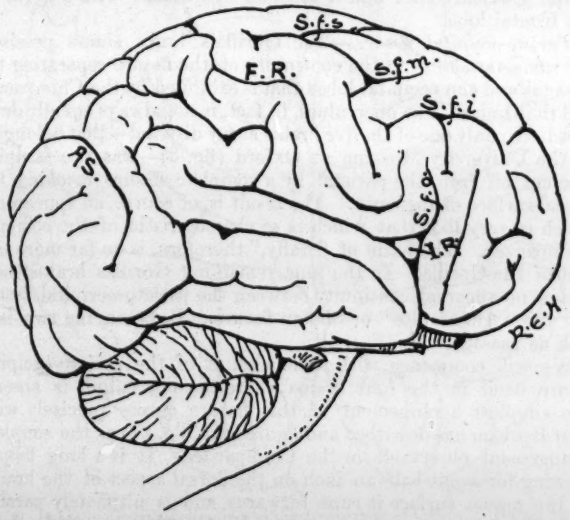
consequence of this deficiency I have thought it advisable to have a number of simple drawings prepared, which are, in my opinion, much more useful than elaborately shaded, but imperfectly lettered, lithographs. My object in this contribution is a very modest one A little too much, perhaps, of elaborate description, comparison and generalization is sometimes based upon inadequate material

this is partly responsible for the enormous brain literature that exists. I propose in the following pages to make my descriptions as short as possible and to forbear from much comment and comparison.

As regards the general shape of the brain, I have no remarks to offer except as to the keel upon the ventral or orbital surface of the frontal lobes. I am disposed to think the existence of this keel is a normal feature of the Gorilla's brain as it is of that of the Chimpanzee. In the two best-preserved brains at my disposal it was very clearly marked. I laid some stress upon the difference in this particular which the brain of "Sally" showed from that of other Chimpanzees. I am now not at all convinced that a larger series would bear out such a distinguishing character. I infer from a remark of Dr. Benham's that the Orang's brain is also believed to be without this keel. The keel was well marked in one of three Orang brains in my possession.

The Sylvian fissure and island of Reil.—The most noteworthy point that I observed in relation to these portions of the brain is

Fig. 2.



Brain of Gorilla belonging to Royal College of Surgeons. Lateral view.

I.R. Island of Reil. *S.f.o.* Fronto-orbitalis.
Other letters as in fig. 1.

the occasional exposure of a portion of the island of Reil. This is seen in fig. 2, which represents one side of the brain belonging to the Royal College of Surgeons. It was visible also on the other side

of this brain. It was visible also in the Oxford brain to about the same extent; and equally clearly in one of the three other brains at my disposal. The appearance of the island of Reil upon the surface of the brain completely shut off by sulci from surrounding regions would thus appear to be a fairly common feature of the Gorilla brain[1].

As to the Chimpanzee, the same exposure of the island at a lower level than the rest of the surface occurred in one of the two brains which I examined. I simply record, as to the Chimpanzee, my own observations without attempting any statistics.

In the brain which I have selected for figuring the exposed island of Reil was exceedingly conspicuous on account of the fact that it is depressed below the surface of the brain and completely surrounded by furrows. It is thus cut off from other gyri in all of the three brains to which reference has just been made. In two of the remaining brains which I have examined the island of Reil appeared at first sight to be not exposed upon the surface of the brain. This appearance I believe to be delusive and to be due to the fact that there is no anterior sulcus dividing off the island from the gyri of the frontal lobe; the level of the island gradually rises and it becomes continuous with a gyrus of the frontal lobe.

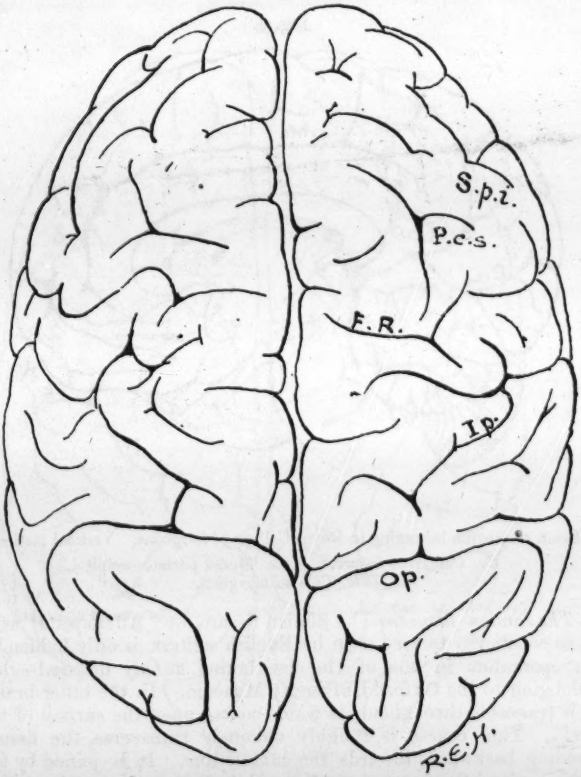
Parieto-occipital fissure.—The Gorilla's brain shows precisely the same variability in the continuity of the fissure separating the parietal and the occipital lobes that is exhibited by the Chimpanzee and the Orang. The operculum, in fact, is not always equally developed. In only one of the five brains at my disposal—that belonging to the University Museum at Oxford (fig. 3)—was the occipital lobe cut off from the parietal by a complete fissure reaching the mesial surface of the brain. The result is, of course, an appearance which is very like that which is so characteristic of the common Chimpanzee. The brain of "Sally," therefore, is so far more like that of the Gorilla. In the four remaining Gorillas' brains there is thus no apparent continuity between the parieto-occipital fissure and the "Affenspalte" or Simian fissure. Between the two is a "pli de passage."

We will commence with some account of the parieto-occipital fissure itself in the four brains where the operculum is absent. The simplest arrangement of this fissure agrees precisely with what Benham has described and figured (15. fig. 21) as the simplest arrangement observable in the Chimpanzee. It is a long fissure showing for about half an inch on the dorsal aspect of the brain; on the mesial surface it runs forwards and is ultimately parallel to the calcarine. I only discovered this simplest state of affairs in two separate half-brains. In the corresponding half to one of these the fissure was the same, excepting for the addition of a forward branch. In the half corresponding to the other of the two brains just mentioned there was an apparent difference of

[1] Dr. v. Bischoff found it in *all* the brains that he examined.

some importance. The Y-shaped fissure was visible on the mesial surface, and *between the forks of the* Y *extended down for a short distance from the upper surface of the brain a fissure.* The arrangement, in fact, is closely like that figured by Benham in figs. 24 and 29 of his paper. I shall follow him in terming the short middle fissure the lateral parieto-occipital and the Y-shaped

Fig. 3.



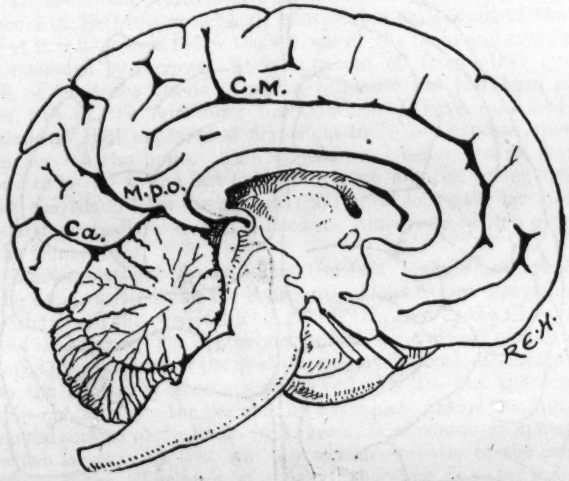
Brain of Gorilla belonging to the University of Oxford. Dorsal view.
Op. Operculum. Other letters as in fig. 1.

fissure the mesial parieto-occipital. I have used the expression "apparent difference" to distinguish this hemisphere from that in which the sum total of the parieto-occipital fissures was represented by one Y for a good reason. When the furrow of that hemisphere is explored by pushing aside its margin a median

lateral parieto-occipital comes into view lying between the two forks of the Y.

In the third brain, as will be seen from the drawings exhibited, the arrangement is practically the same; and one side of the brain belonging to the College of Surgeons (fig. 4) offered no differences. The other side of that brain is not so easy of explanation. It seems, however, to be, like the simplest case, complicated by an additional branch running towards the calcarine.

Fig. 4.



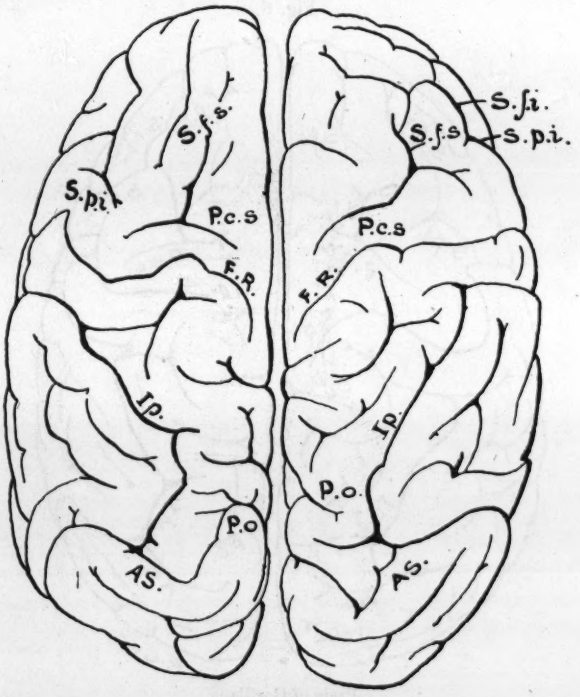
Brain of Gorilla belonging to Royal College of Surgeons. Vertical section.
Ca. Calcarine fissure. *M.p.o.* Mesial parieto-occipital.
C.M. Calloso-marginal.

The Simian fissure.—The Simian fissure, or "Affenspalte" as it is so constantly termed even by English writers, is only hidden by an operculum in one of the five brains at my disposal—that belonging to the Oxford University Museum. In the other brains it is traceable throughout its whole course upon the surface of the brain. This course is roughly obliquely transverse, the fissure bending backwards towards the middle line. It is joined by the intra-parietal fissure at about the middle of its extent. An exceptional state of affairs is seen in the brain represented in fig. 5. Here the fissure on both sides takes a bend forward and reaches the mesial surface, becoming continuous with a portion of the parieto-occipital.

Fissure of Rolando.—Some stress has been laid upon the position of this fissure as marking the posterior boundary of the frontal lobes and as thus determining their relative size. Cunningham

shows from his tables that the position of this fissure in the Chimpanzee and the Orang is a little further behind the middle of the cerebrum than is the case with Man, but that the human fœtus roughly corresponds in these measurements with the adult anthropoid. On the other hand, Benham finds that the fissure of Rolando in the Chimpanzee "Sally" is in front of the middle line. It cannot be said, therefore, that the greater length of the frontal lobe is a character of the Anthropoid Apes as contrasted with Man.

Fig. 5.



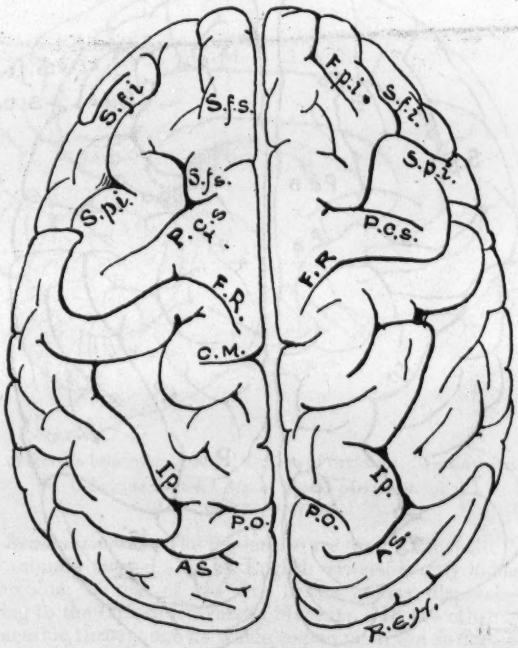
Brain of Gorilla.

Letters as in fig. 1.

One cannot be convinced in spirit-preserved brains that the shrinkage has been uniform. It is doubtful, therefore, how far accurate measurements are of use. But I may observe that in the best-preserved brain at my disposal (fig. 6, p. 72), and in another not quite so good, this fissure was at its posterior end (on the right side; on the left the fissure was a little longer) exactly in the middle of

the antero-posterior diameter of the hemisphere. In the Oxford brain it was most patent, without any measurements at all, that the fissure was much in front of the middle line. Tape measurement gave the total length of a hemisphere as $5\frac{1}{8}$ inches and $2\frac{3}{8}$ the length of the pre-Rolandic portion. This seems too great a difference to be accounted for by defective preservation resulting in unequal contraction. After two such divergent observations it seems to be difficult to deduce any conclusions which bear upon the relative sizes of the two lobes in question. There is evidently much variation.

Fig. 6.



Brain of Gorilla.

Letters as in fig. 1.

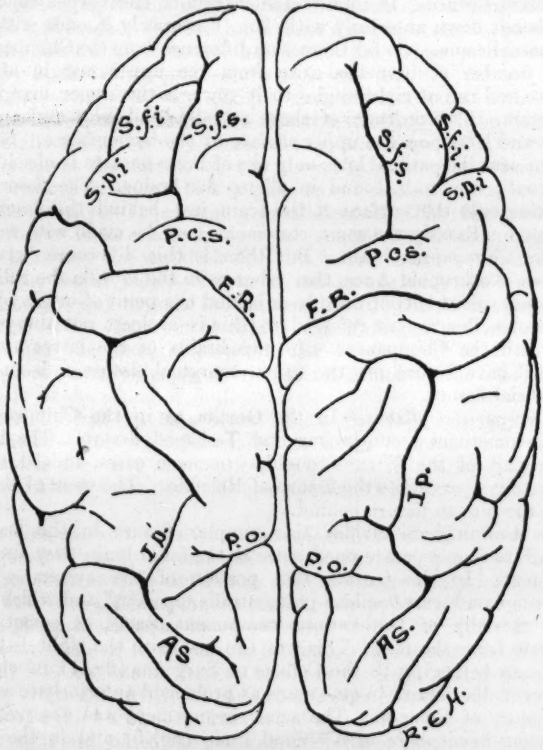
This fissure varies too in its length, sometimes cutting the mesial surface of the brain superiorly and reaching the Sylvian fissure below; it is not always so long.

In only one of the five brains at my disposal (fig. 7) did the Rolandic sulcus actually cut the margin of the brain and disappear from view when the brain was examined from above; this, moreover, was only on the right side. In the other brains were exhibited

various degrees of nearness to this extreme. In two brains, though this fissure was visible in its entirety from above, it did just turn over the border so as to be visible from the mesial side.

It is equally rare for the fissure to reach the Sylvian fissure. In only two half-brains (the right in one case and the left in the other) did this occur.

Fig. 7.



Brain of Gorilla. Dorsal view.
Letters as in fig. 1.

Calcarine fissure.—The extreme difficulty of laying down any laws as to the course of particular fissures from the examination of only a small number of examples is well illustrated by the condition of this fissure in the Anthropoid Apes.

Prof. Cunningham arrived at the conclusion that the junction of this fissure with the parieto-occipital to form a Y-shaped figure was distinctive of Man as opposed to the Anthropoid Apes.

But later Dr. Benham found this precise arrangement in the brain of *Anthropopithecus calvus* and in another Chimpanzee. Whether the Gorilla's brain shows the same variability or not I am unable to state; but at any rate there was no such junction in three of the brains which I examined. On the other hand, in the brain of a common Chimpanzee this junction was obvious on both sides.

Calloso-marginal fissure.—This is long and deeply engraved upon the brain-surface. It follows the margin of the corpus callosum and bends down anteriorly with it. Posteriorly it ends with the corpus callosum. So far there is no difference from the Chimpanzee.

A number of branches arise from the upper margin of the fissure and run at right angles to it towards the upper margin of the brain. Two or three of these actually bend over and appear right and left upon the upper surface of the hemispheres. So far as concerns the parietal lobe, only one of these fissures is absolutely constant; it is to be found in all my five brains. The fissure in question cuts the surface of the brain just behind the fissure of Rolando. Exactly the same statement may be made with regard to the Chimpanzee brain. But there is this difference between the two Anthropoid Apes, that whereas in the Gorilla the calloso-marginal sulcus is continued back behind the point of origin of the transverse fissure just referred to, this is at least not always the case with the Chimpanzee. In two brains of the latter animal which I have before me the calloso-marginal fissure ends in this superficial fissure.

Intra-parietal fissure.—In the Gorilla, as in the Chimpanzee, this is sometimes a continuous and T-shaped fissure. The horizontal part of the T runs roughly—in some cases, indeed, more accurately—parallel to the fissure of Rolando. The stem of the T joins the Simian fissure behind.

Dr. Cunningham divides this complex fissure in the human brain into four separate ones, since in the fœtal brain they are not confluent. In the Gorilla that portion of the system which Cunningham terms "sulcus postcentralis superior," and which lies most mesially of the various component parts, is sometimes separate from the rest. This was the case with the right half of the brain belonging to the College of Surgeons (fig. 1), in which, moreover, the furrow in question was prolonged anteriorly to reach the fissure of Rolando. The same arrangement was observed in the same hemisphere of a second brain (fig. 5) and in the left hemisphere of a third (fig. 7), save that in neither of these was there a junction with the fissure of Rolando. In two other brains these various sections were confluent.

There is thus in the Gorilla precisely the same variability in respect of these fissures that occurs in the Chimpanzee. It is no more the "usual condition" in the Gorilla than it is in the Chimpanzee for the sulcus postcentralis superior to be confluent with the rest of this system of fissures.

Sulci of the frontal lobe.—It may be convenient to describe these furrows in some elaboration in a given brain and then to describe

the divergences from this artificially created normal. For this purpose I shall select the brain belonging to the Royal College of Surgeons.

On the left side of this brain (fig. 1) there is a short *præcentralis superior* roughly parallel to the fissure of Rolando. From it extends forwards the *sulcus frontalis superior*, divided into two by a break and apparently ending anteriorly in a fork; but a short furrow belonging to this system arises between the extremities of the fork and extends forward for a short distance. Again, parallel with the fissure of Rolando, but below the *sulcus præcentralis superior*, is the *sulcus præcentralis inferior*. Of this furrow the *ramus horizontalis* is very oblique and communicates with the fissure of Rolando. From the mesial extremity of the ramus horizontalis arises the very short *sulcus frontalis medius*.

From about the middle of the præcentralis inferior arises the *sulcus frontalis inferior*, which is quite as extensive a furrow as the frontalis inferior. It is roughly parallel to it. The first portion of the furrow forks exactly as does the frontalis superior, and again in the same way the distal part of the furrow arises between the fork. The *sulcus fronto-orbitalis* is continuous with the Sylvian fissure below, and bounds the anterior side of the (here exposed) island of Reil. In front of this is the Y-shaped *sulcus fronto-marginalis*; the stem is perpendicular to the long axis of the hemisphere; finally the pre-Sylvian fissure completes the triangular boundary of the island of Reil.

The right half of this brain shows the following principal differences:—The *frontalis medius* is much longer; the *ramus horizontalis* does not communicate with the fissure of Rolando. The *frontalis inferior* does not communicate with the *præcentralis inferior*.

The *præcentralis superior* nowhere differs greatly from the arrangement which obtains in the brain that has just been described. It never is continuous with the præcentralis inferior as is the case with a Chimpanzee's brain in my possession.

The *frontalis superior* in other brains shows variations in the degree and manner in which it is broken up into segments. Sometimes it is a continuous fissure; this was the case with both sides of one brain and with one side of another. In the right hemisphere of a third brain the first part of this fissure became deflected to the right and joined the præcentralis inferior (fig. 6).

Præcentralis inferior.—In three hemispheres (belonging to different brains), in addition to the College of Surgeons' brain already referred to, the ramus horizontalis cut the Rolandic fissure.

The *sulcus frontalis medius* is not a prominent feature of any of the brains at my disposal. The smallness of its size in the College of Surgeons' brain has been commented upon already; it is present and also small in only one hemisphere out of the four remaining brains examined by me. In the rest I can find no vestige of it. It might possibly be held that the furrow marked *F.p.i*, in fig. 6, is really a portion of the medius. But I think that

the brain illustrated in fig. 1 (p. 66) does away with this supposition, since the fissure which evidently corresponds to *F.p.i.* of fig. 6 is clearly continuous with and a part of the sulcus frontalis superior.

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2. Note on the Presence of Supernumerary Bones occupying the Place of Prefrontals in the Skulls of certain Mammals. By Robert O. Cunningham, M.D., D.Sc., F.L.S., F.G.S., C.M.Z.S., Professor of Natural History, Queen's College, Belfast.

[Received November 21, 1898.]

About two years ago[1] I addressed a brief communication to the Zoological Society on the occurrence of a pair of small bones in the skull of a Lemur, occupying a corresponding position to the prefrontals of a Reptile. In that paper I referred to similar bones having been previously recorded in the skull of a Hippopotamus.

[1] *Cf.* P. Z. S. 1896, p. 996.

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FIG. 1. MUS HIRTENSIS. FIG. 2. MUS MURALIS.

Since then I have met with two instances of the same kind in the skulls of Marsupials. The first of these I detected in the skull of an apparently adult *Macropus giganteus* in the Museum of the Royal University of Ireland. In this case the bone was only recognizable on the right side as a distinct ossification, while on the left the suture between it and the lachrymal had disappeared. The second instance I found in the skull of an adult Wombat (*Phascolomys platyrhinus*) in the Natural History Museum of Queen's College, Belfast. Here the bone was well developed on both sides of the skull, and distinctly separated by suture from the frontal, nasal, maxilla, and lachrymal. It is worthy of note that, in his memoir on the 'Modifications of the Skeleton in the Species of *Phascolomys*,' the late Sir Richard Owen does not seem to have recognized this pair of bones, notwithstanding that they are clearly displayed in more than one beautiful figure of the skull by his artist, Mr. Smit.

The occurrence of such bones in Mammals so far removed from one another as a Lemur, a Hippopotamus, and two Marsupials suggests the probability of their being less uncommon in the mammalian skull than would at first appear, and I have little doubt that any naturalist who possesses the requisite time and opportunities for conducting the research in a large osteological museum would add to the list of such instances.

3. On the Species of the Genus *Mus* inhabiting St. Kilda.

By G. E. H. Barrett-Hamilton, F.Z.S.

[Received December 5, 1898.]

(Plate IX.)

The existence of any wild species of Mouse on the isolated rock of St. Kilda is an occurrence so apparently unlikely, that when in 1895 a specimen of a *Mus sylvaticus*-like species was found amongst some examples of *Mus musculus* sent thence to the British Museum in spirit, it was received with an amount of surprise certainly equal to the importance of the discovery. The specimen, a young male, had been obtained and was presented to the Museum by Mr. J. Steele Elliott [1]. It was a very remarkable one, and bore unmistakable evidence of having come from an out of the way part of the world. Its characteristics were a larger foot and a smaller ear than the corresponding organs of typical *Mus sylvaticus*, while, what was no less noticeable, the very characteristic snow-white colour of the belly of our common Field-Mouse was in this individual replaced by a uniform rufous hue shading imperceptibly

[1] Mr. Steele Elliott appears to have been the first person to collect specimens of the Mice of St. Kilda. The occurrence there of mice of some sort was, however, known previously to the outer world, and Seton states that "A cat is to be seen in almost every cottage, the mouse being the only wild animal on the island, and rats are still unknown" ('St. Kilda, Past and Present,' 1878, p. 132).

through the flanks to the peppery reddish-brown of the upper surface.

All these peculiarities seemed to clearly point to a new species or subspecies of Mouse; but the animal having been in spirit, its colour was regarded as unsatisfactory, and the unusual proportions of its ears and tail were ascribed to individual variation. And so the specimen was put on one side in the hope that in due time further examples might be procured.

Early in the spring of the present year I happened to come across the specimen, and, being greatly struck by its remarkable appearance, I at once endeavoured to procure some more of these St. Kilda Mice, with the result that my friend Mr. Henry Evans, during the course of a yachting cruise among the Scotch Islands, put in at St. Kilda and landed some traps for me on the island. Thanks to Mr. Evans, I have now before me, in addition to Mr. Steele Elliott's specimen, a fine adult pair, male and female, as well as a young female, of the St. Kilda Mouse, all sent down in spirit.

The dimensions, in millimetres, of these St. Kilda Mice are as follows:—

	Head and body.	Tail.	Hind foot.	Ear.
♂ (skin: J. Steele Elliott. 1894; Brit. Mus. Coll. no. 94.7.16.1)	81	85	25	—
♂ (skin: H. Evans, 1898; Coll. G. E. H. B.-H. no. 556)	107	91	24·5	17
♀ (spirit: ditto; ditto)	110	94	24	15
♀ („ juv.: ditto; ditto)	82	77	24·5	15·5

They are thus remarkably large mice for typical *Mus sylvaticus*, and the adults equal in size the largest measurements of the form known as *Mus flavicollis* Melch. The skull of the adult male is as large an example as I have ever seen, reaching a total length of 29 mm.

The following list of total lengths of the skulls of various *sylvaticus*-like forms will illustrate this point:—

		mm.	
M. flavicollis,[1]	♂	29	Suffolk.
„	♂	28 (W. 264)	Hereford.
„	♂	27 (W. 137)	„
„	♀	28 (A. 28)	„
„		28 (W. 75)	
M. hebridensis,	♂ (type)	27	
M. sylvaticus (old)		26 (W. 10)	
„	(in general)	26 to 27.	

In form and proportions these mice resemble *Mus hebridensis*,

[1] The majority of these specimens have been placed at my disposal by my friend Mr. de Winton, and the numbers appended are those affixed to them in his collection.

the form of *M. sylvaticus* described by my friend Mr. W. E. de Winton[1] from the Isle of Lewis, Outer Hebrides. The adult female from St. Kilda (which is in spirit) may possibly not be so stout in foot nor so small in ear as the Hebridean Mice, but the two forms are very close to each other, and there can be no doubt that the St. Kilda Mice belong to the Hebridean type, although their rufous belly has carried them a little further along the same line of development in which *Mus hebridensis* deviates from typical *sylvaticus*. In this respect I find that the most rufous skin of all is the first one collected by Mr. J. Steele Elliott. In it there is no perceptible line of demarcation between the colours of the upper and under surfaces, the transition from the one to the other being, as stated above, quite gradual. As regards the specimens obtained for me by Mr. Evans, the colour of the belly of the adult female, which is in spirit, agrees with that of Mr. Steele Elliott's specimen; but in the male, which has been made into a skin, the belly is slightly lighter, the median broad buff belly-line of *Mus hebridensis* is more evident, and there is a just perceptible line of demarcation between the colours of the two surfaces. The colour of the upper surface of the body of all the specimens is also, as in *Mus hebridensis*, more evenly distributed than in typical *sylvaticus*, there being less tendency to the development of a dark dorsal line.

It is exceedingly interesting to find this graduating series, and to have the gap between *Mus sylvaticus* and the St. Kilda Mouse partially bridged over by the occurrence of *Mus hebridensis* on the intervening islands.

This slight variation of the St. Kilda specimens in regard to the colour of the belly, the white colour of which is so extremely constant in and characteristic of *Mus sylvaticus*, is worthy of note, being exactly what we should expect to find in a comparatively new species which has not yet finally settled down into its new groove of development. We thus find that while in the colour of the belly some of the St. Kilda Mice may vary in the direction of *Mus hebridensis*, it is in this very respect that the latter form may vary in the direction of *Mus sylvaticus*. Indeed, in this regard *Mus hebridensis* is very variable, and I have examined some Isle of Lewis specimens, especially those from the eastern coast, which come very close to *Mus sylvaticus* in the colour of the underside.

In addition to the above mice, Mr. Evans also procured for me five specimens of the House-Mouse of St. Kilda, of which the Museum already possessed five specimens collected on previous occasions and now preserved in spirit. These mice are, if possible, of even greater interest than the *Mus sylvaticus*-like species, since they are characterized by the possession of a buff-coloured underside clearly marked off from the colour of the upperside by a distinct line of demarcation, and are thus very different from the ordinary almost uniformly smoky-brown-coloured House-Mice

[1] Zool. 1895, p. 369.

with which everyone is familiar. The upper surface is not of the typical smoky *musculus* tint, but of a sepia-brown with a grizzled appearance, due to many of the hairs being tipped with rufous. The lower parts of the hairs are exactly of the same shade as in *Mus sylvaticus*, for a dark specimen of which, at a casual glance from above, the animal might almost be mistaken. All these mice—even the very young ones—agree in presenting similar characters, and altogether are quite the most distinct local form of *Mus musculus* which I have ever examined.

In form and proportions these mice are well-developed large House-Mice, only differing in this respect from ordinary mice in being above the average size. The dimensions of the series which I have been able to examine are as follows (in millimetres):—

	Head and body.	Tail.	Hind foot.	Ear.	
♀ skin (suckling: Coll. G. E. H. B.-H. no. 534)	90	85	17	14	1898.
♀ (spirit) „ „	88	81	15	12	
♀ „ „ „	78	79	15	12·5	
♀ „	87	84	16·5	13	
♀ (spirit), suckling	83	78	18	13	Brit. Mus. Coll. nos. 94. 7. 16. 2 & 3, presented by Mr. J. Steele Elliott through Mr. J. E. Harting.
♀ „ „	85	85	17·5	13	
♂ (juv.) (spirit)	75	65	16	10	Brit. Mus. Coll. no. 96.8.6.1, presented by the Kelvingrove Museum.
♀ (spirit), very young ...	52	52	14	10	1898.
— „ „ ...	65	67	15	10	Brit. Mus. Coll. nos. 94. 7. 16. 2 & 3 (duplicate), presented by Mr. J. Steele Elliott through Mr. J. E. Harting
— „ „ ...	53	60	16	10·5	

The arrangement of the mammæ is as in *Mus musculus*, there being 10 pairs in all, of which three are pectoral and two inguinal.

The skulls and dentition of these mice are in general appearance and size very *musculus*-like in character, but the triangular narrowing of the internal opening for the nostrils is even more strongly marked than in ordinary specimens of *Mus musculus*. All the St. Kilda skulls possess this peculiar narrowed palate, a character which I can only find in one out of over fifty specimens of *Mus musculus*-like Mice in the British Museum collection, and that one is a specimen of the subspecies *Mus musculus jalapæ* Allen and Chapman, from Mexico. The greatest lengths of four skulls from St. Kilda are 22, 22·5, 23, and 23 millimetres.

It is obvious that, according to the custom of modern naturalists, these two forms of Mice need new names, which I therefore propose to give, leaving the question as to the exact status of the two new forms to be decided when we are in possession of a fuller knowledge of the other species or subspecies of Mice of the *musculus*- or *sylvaticus*-like groups. As to the desirability of bestowing names

on the two Mice from St. Kilda I can have no doubt whatever; but as to whether they are fit subjects for a binomial or for a trinomial treatment I am less certain, until I have had time to study the *musculus*- or *sylvaticus*-like Mice of the whole Palæarctic Region. For many reasons it would seem convenient to apply the trinomial system to all forms which can be clearly shown to be local developments of any other form. By such a method a clue is given to the relationships of the various local forms—a matter of no small importance to the student of a large and difficult genus like that of *Mus*.

On the other hand, we have in the present instance two forms which, although obviously coming within the above definition, are perfectly isolated, and do not, so far as we know, intergrade with the parent form. Regarded from this point of view, they have as much claim to be accorded full specific rank as any other island species, and the latter is, perhaps, the most satisfactory method whereby to deal with them.

The following are the names which I propose:—

Mus hirtensis, sp. nov. (Plate IX. fig. 1.)

Closely allied to *Mus hebridensis*, from which, however, it differs in its slightly larger size, as stated above, and also in the greater amount of buff or yellowish-brown coloration on the underside. Like *Mus hebridensis*, it differs from typical *sylvaticus* in the more uniform coloration of the upper surface of the body, in the absence of the clearly defined white underside, and in the longer feet and smaller ears.

The skull is similar to that of *Mus hebridensis*, but appears to be larger, equalling in size that of the largest specimen of *Mus flavicollis*.

The type is No. 94.7.16.1 (British Museum coll.), the young male first collected by Mr. J. Steele Elliott.

Mus muralis, sp. nov. (Plate IX. fig. 2.)

In shape and proportions allied to *Mus musculus*, but more robust and larger in size. In general colour of the upper surface resembles a dark specimen of *Mus sylvaticus typicus*, the base of the hairs being of the same colour as in that species, but having the extremities of the majority of a sepia-brown colour; mixed among these are a certain proportion of rufous-tipped hairs, which give the animal a grizzled appearance. The colour of the under surface is very remarkable, being buff, clearly separated by a well-marked line of demarcation from the colour of the upper surface of the body.

The skull, as compared with that of typical *Mus musculus*, is remarkable for the greatly exaggerated narrowness of the posterior opening of the nostrils.

The type is No. 534 of my own collection: it is an adult female procured for me in 1898 by Mr. Henry Evans.

The interest pertaining to these two Mice, which undoubtedly represent local developments of *Mus sylvaticus* and *Mus musculus*, will be better appreciated if I briefly discuss the variations to which these two species are subject in other localities.

I assume, however, from the outset that in neither case am I dealing with an animal which may have been recently introduced to the island. The great amount of variation from the type of a species which varies so little as *Mus sylvaticus*, as shown in the one case, and the evolution of a perfectly uniform and distinct type of coloration in one so variable as *Mus musculus* in the other, are both characters which would seem to have taken no inconsiderable time for their development. So that even if, as is probable, the presence of a *Mus musculus*-like species of Mouse on St. Kilda be due originally to a case of introduction, such an introduction could not have taken place at a very recent period in the history of the island, which is known to have been inhabited for at least several centuries.

The distribution of *Mus sylvaticus* is almost coterminous with the limits of the Palæarctic Region, the species only just reaching the confines of the Oriental Region "in Gilgit, where it is common from 5000 to 10,000 feet elevation" (Blanford, Faun. Brit. Ind., Mamm. p. 416). In the former region it is probably as widely spread as any other mammal, as it seems to be very regardless of the influence of temperature, and is found far up the slopes of the mountains. It is equally at home in all the countries (except probably the Arctic tundras and the great sandy deserts) from the eastern coast-line of China to the Atlantic. It has reached Morocco, Algeria, and Palestine, and has found its way to most of the Islands, such as those of the Mediterranean, the Channel Islands, Great Britain, Ireland, the Scotch Islands, the Shetlands[1], and even Iceland, where the local form (*Mus islandicus* Thien.) is said to be the only indigenous species of mammal.

Its presence in such isolated, yet widely-separated, islands as Iceland and Corsica seems to mark it as a species which has for long maintained a wide area of distribution, and which had already occupied the greater part of its present range before these and the other islands where it is now found were finally separated from the continent as such, but still formed a part of the continuous Palæarctic land-area. And of its antiquity we have sufficient proof, for its bones have been found in numerous caves on the Continent and in the English Forest-bed (see E. T. Newton, Quart. Journ. Geol. Soc. vol. l. pt. 2, no. 198 (May 1st, 1894), p. 195), and we have no trace of its ancestry, the Pleistocene species, *Mus orthodon* Hensel and *abbotti* E. T. Newton, being at least as specialized as itself.

Not only is *Mus sylvaticus* of exceedingly wide distribution, but

[1] A set of four from Dunrossness, for which I am indebted to Mr. Henderson, has recently reached me; I am unable to separate them from *Mus sylvaticus* of Western Europe and Great Britain, and the same remark applies to some specimens collected for me by Mr. W. Eagle Clarke on Alderney.

throughout the immense area where it is found it remains remarkably constant to a single well-marked type. Throughout the Palæarctic Region it is distinguishable at a glance from every other Mouse with which it might possibly be confounded by the pattern of its teeth, its long foot, large ears, and pure white belly, separated from the rufous colour of the upperside by a strong and clearly-marked line of demarcation. It is true that these peculiarities show a slight tendency to local variation, so that two or three local forms of *Mus sylvaticus* may be recognized; but the variation is so slight that it takes a specialist to distinguish *Mus chevrieri* M.-Edw., of Tibet and China, from *Mus arianus* Blanf., of Persia and Afghanistan, or *Mus sylvaticus* Linn., of Europe.

Within the confines of Europe the animal seems to hold quite firmly to one particular type, so that I am unable to distinguish specimens obtained in Corsica from those of Ireland or France.

Mus sylvaticus is, then, obviously a species which in its long-standing and successful struggle for existence has attained to a height of specialization from which it has either very little power of variation, or else which is such as to fulfil all the needs of the species in almost any conditions with which it may be brought into contact. It is a species which further and even minute study may find unprofitable, or even impossible, to split into local subspecies. Not that I wish to imply that local variations are absent or even rare in *Mus sylvaticus*: they are by no means so, but their presence is infinitely less abundant or conspicuous than is the case with other and perhaps equally wide-spread mammals.

It is also extremely interesting to find that the representatives of *Mus sylvaticus* in the Hebrides and St. Kilda show as much divergence from the type as examples from any other locality with which we are acquainted, and it is an evident sign of the antiquity of the animal at St. Kilda, and a seemingly irrefutable argument against any theory of its introduction into the island—apart from the fact that its presence in the Channel Islands, in Iceland, Norway and Sweden, the Shetlands, Ireland, and the Inner and Outer Hebrides marks it out as the species *par excellence* of all others in the Palæarctic Region which we should most expect to find in such an out-of-the-way island. And to judge by its large size and robust form, it has had no difficulty in maintaining its existence on St. Kilda.

I therefore think that we have a good deal of evidence to support us in supposing that *Mus hirtensis* is indigenous to St. Kilda, and indeed the very position of this rock, facing as it does the Western Hebrides and with a channel of no very great depth between it and them, throws no difficulty in the way of the hypothesis that the continuous land-area which enabled *Mus sylvaticus* to reach the Shetlands, Scotland, the Hebrides, and Ireland, should have included also St. Kilda in its surface, a state of things which might be produced by an elevation of about 60 fathoms only.

That such a land-connection must have been of geologically quite recent date is a matter of no difficulty for a zoologist,

since the whole of our British Mammalian fauna is so similar to that of the Continent that it is inconceivable (unless *all* the species are introductions) that it can have existed in our islands for any, geologically speaking, long period of time. Even the most plastic of British Mammals, such as the Squirrel[1], have only advanced a comparatively short distance on the road of differentiation; and as regards Birds there is a precisely similar story to be told, there being only one really well-differentiated peculiar British species, the Red Grouse, *Lagopus scoticus* (Lath.). In fact, one of the strongest arguments against my friend[2] Dr. R. F. Scharff's brilliant theories as to the antiquity of the Irish fauna (which is presumably older than that of Great Britain) is that, were it so old as he would make it, we should expect to find not only peculiar species but even peculiar genera among the mammals of Ireland, whereas a most careful study has hitherto only sufficed to distinguish one certainly peculiar species, the Irish Stoat, *Putorius hibernicus* Thom. & H.-B., and that bears in itself very clear evidence of its recent origin. Another species or subspecies, the Irish Hare, *Lepus hibernicus* Bell, seems also to be distinguishable, but it is not nearly so distinct as the Stoat. Among Birds, Reptiles, and Amphibians naturalists have hitherto failed to find any peculiar local forms, although it is evident that the Grouse of Western Great Britain and of Ireland is following the same route as the Irish Stoat and Hare.

Can there, then, be any great difficulty in supposing that *Mus hirtensis* is indigenous to St. Kilda, and that it reached the island at a comparatively recent geological period, when a land-surface existed connecting the Shetlands, Orkneys, Scotland, the Hebrides, St. Kilda, and Ireland, and that this connection must have been so recent geologically that few of our native mammals have had time to develop into species or even subspecies distinct from those of the Continent of Europe? That the Mouse of St. Kilda should be the one in which variation has proceeded farther than in other localities is quite in accordance with the isolated situation of and confined space on the rock, together with its full exposure to the Atlantic winds; and we have an apparently parallel instance in the case of the Wren of the island, *Troglodytes hirtensis* Seebohm, and perhaps also in the possible existence of a race of small dark-coloured Field-Mice[3] in the West of Ireland.

To assert that the Mouse of Iceland has reached that island along a formerly continuous land-area would be a very different matter, since not only is there a deep channel between the Faroes and Iceland, and even between the former islands and the Shetlands, but if we consider that *Mus islandicus* is native to Iceland, then we should expect to find a similar or representative species in the Faroes, and of that we have as yet no record.

Yet that there has *never* been such a land-connection will not,

[1] *Sciurus leucourus* Kerr.
[2] See Proc. R. I. Acad., July 1897, p. 427.
[3] See Jenyns, Ann. & Mag. Nat. Hist. vol. vii. p. 268 (1841).

I suppose, be contended by anybody, so that the question in reality resolves itself into one dealing with the time at which such a connection existed, and whether it has been sufficiently recent to allow of a passage along it of such a presumably recent mammal as a Mouse. Although we cannot expect to decide such questions from a mammalian point of view alone, it is profitable to remember that such "an old land extension connecting Greenland, Spitzbergen, and Scandinavia with Scotland and Ireland" is relied upon by the Editors of the recently published second edition of the 'Cybele Hibernica' (Introduction, pp. li & lii) as the only reasonable explanation of the presence in Ireland, and undoubtedly native there, of three plants of North-American habitat, two of which are unknown in Continental Europe; nor would there seem to be any better explanation forthcoming to account for our share in Ireland of certain Invertebrates which are indistinguishable from North-American forms [1].

Similarly Mr. A. H. Keane [2], although writing on a widely different subject, regards the "submarine bank which stretches from Scotland through the Faroes and Iceland to Greenland" as representing "a vanished Continent of great age, which would appear to have still formed dry land in late Tertiary times."

But the present paper deals not with the question of a submerged Euro-American Continent, but with the Mice of St. Kilda, and I must content myself with pointing out in conclusion that the recent exploring expedition to Rockall [3], the most westerly rock-islet off the European Continent, found that when trawling at a distance of about 15 miles south of that rock, "the water shoaled to 80 fathoms, and there was brought up in the bag a most unexpected assortment of shallow-water shells, evidently long since dead. Amongst these were several kinds of Pecten, *Venus casina*, *V. fasciata*, *Mytilus modiolus*, &c." In the words of the Rev. W. S. Green, "How, under present conditions, such shells could be found living anywhere on the bank was difficult to understand. It would seem to afford the strongest confirmation to the theory that the time is not so very long distant when there was more land, with a shallow coast-line, and possibly extensive sand-banks, where now the pinnacle of Rockall is the only speck acting as a memorial stone to what tradition has called the 'Sunken Land of Buss.' After the shallow sand-banks had vanished, these mollusks may have accommodated themselves to a deeper sea than is usual for such organisms to live in, and it may be that it is only now that the conditions are becoming too severe for their further existence. There is, of course, the possibility that these shells may have come from the bottom of icebergs which had grounded in Greenland or Spitzbergen bays, but I doubt if in times sufficiently recent such bergs have visited the position occupied by Rockall, and therefore the former theory seems the more probable.

[1] See 'Irish Naturalist,' iv. pp. 25, 122; vi. pp. 225, 257.
[2] 'Ethnology,' 1896, p. 231.
[3] See Trans. R. I. Acad. vol. xxxi. pt. 3, pp. 45–46 (1897).

"The possibility of the shells having been brought as bait for the lines of the fishing-boats visiting the bank is, I think, disposed of by the mixed character of the deposit, some of the shells being unsuitable for such a purpose. It would be interesting to trace out the area occupied by these dead shells, and, possibly, to search in a similar manner for the lost land of Hy Brassil on the Porcupine Bank, but the time at our disposal only gave us the chance for one dip into this deposit."

Turning to *Mus musculus* we have to deal with a very different species, and I do not in this case attempt to prove that this animal has reached St. Kilda without the help of man. That it must have existed there for a considerable time, perhaps for hundreds of years, is, however, as I hope to show, very probable. Well known and widely spread in almost all regions where the habitations of man afford it a refuge, it is impossible to state what is the native home of the species. Not only is the domestic form of *Mus musculus* widely spread and readily susceptible of introduction into the houses of its unwilling protector, man, but its variability is as remarkable as is the constancy to type of *Mus sylvaticus*. Still it has never, I believe, been asserted that the species is anything but an introduction into Western Europe and the British Islands.

Light or yellowish varieties of *Mus musculus* have from time to time received names, such as *M. hortulanus* Nordmann, *M. nordmanni* Keys. & Blasius, *M. flavescens* Fisher, and *M. flaviventris* Lataste; the last two names preoccupied by other species of the genus. In addition, however, to these almost domestic members of the *Mus-musculus* group of Mice, we have in many parts of the world wild forms of Mice which, though differing to a greater or less extent in their size, length of tail and colour, cannot be distinguished from *Mus musculus* in their skull and teeth. Such Mice are *M. bactrianus* Blyth and *M. gentilis* Brants, which are widely distributed in the deserts respectively of Asia and N. Africa, and *M. wagneri* Eversm. (= *M. pachycereos* Blanford) of Central Asia, the latter a true House-Mouse, often found inhabiting houses, and differing in no cranial characters from *Mus musculus* proper.

Lastly we have a set of Mice also of varied colours, size of body, and proportion of tail, but mostly characterized by the possession of a white belly, which are found in many of the regions where typical *Mus musculus* occurs. Such are *M. spretus* Lataste, of the Barbary States, and *M. spicilegus* Petenyi, of Hungary, France, Portugal, and Western Europe. These mice may occur in close proximity to the typical *Mus musculus*, as was found by Mr. Oldfield Thomas in Portugal and by myself in Morocco.

Among all these perplexing forms it is indeed difficult to assign a proper place to *M. muralis*, and more so to hazard even a guess as to the possible origin of the domestic races of *Mus musculus*. We know, however, that almost wherever there are deserts there a *bactrianus*-like Mouse is found, so that *M. bactrianus* is perhaps as widely distributed in deserts as is *Mus musculus*

typicus in houses. It seems to me, therefore, probable that both *Mus bactrianus* and *Mus musculus* are developments of some original parent form to suit particular conditions, and we may perhaps look for the latter to some Central Asian species like *M. wagneri*.

Some of the white-bellied forms which are found in a wild state in Western Europe and in other countries where *Mus musculus typicus* occurs in houses may be cases of reversion from the latter, which is no doubt almost certainly the origin of such races as are found on islands, such as the Salvage Islands, where the Mice must have been accidentally introduced. But it by no means follows that this is the case with *Mus spicilegus*, the size and proportions of which are so much finer than in true *Mus musculus* and the tail shorter. *Mus spicilegus*, indeed, might even be regarded as a wild parent form of *Mus musculus*; hence it is not with it, but the forms which are certainly reversions from true *Mus musculus*, that we must associate *Mus muralis* of St. Kilda, and it is interesting to note that the similarly derived Mice of the Salvage Islands resemble those of St. Kilda very closely in their robust form.

That a wild race of *Mus musculus* can be rapidly evolved from Common House-Mice when living in a wild state has been recently shown by my friend [1] Mr. H. Lyster Jameson, who has clearly made out his case for the formation of an incipient species of Mouse on the North Bull, Dublin Bay, Ireland, a tract of sand-hills about three miles in length and almost completely isolated from the mainland.

It is known that this sand-bank has not been in existence for more than about 100 years, so that the coloration described by Mr. Jameson must have been evolved in at most a period of that length.

Mr. Jameson lays great stress on the value of the change to these mice as a protective feature, and so he has not, I think, given sufficient emphasis to the fact that we have here a clear instance of the development of an incipient subspecies of Mouse with an exact period laid down in which the change occurred, and we may fairly, I think, use Mr. Jameson's results in dealing with other species or subspecies of Mice.

If we are to judge from the analogy of Mr. Jameson's mice, we must conclude that the Mice of St. Kilda have inhabited that island for a considerable time. Not only are they more distinct in colour than any other local form of *Mus musculus* with which I am acquainted (and I have been through the whole of the specimens in the British Museum Collection), but their line of development seems to have become fixed, and is no longer, as in the case of Mr. Jameson's mice, in a state of uncertain evolution. On the North Bull sand-hills, indeed, Mr. Jameson found not only mice which had progressed for a considerable distance along the path of their new development, but also mice which showed every kind

[1] Journ. Linn. Soc., Zool. vol. xxvi. pp. 465–473: "On a probable Case of Protective Coloration in the House-Mouse (*Mus musculus*, Linn.)."

of gradation from those which had white bellies to those which exhibited the characters of perfectly typical *Mus musculus*.

I think, then, that we may safely conclude that *Mus musculus* is of at least several hundred years' standing at St. Kilda.

There is one extremely interesting point which should not be forgotten in connection with these two St. Kilda Mice, namely the fact that we have here a clear opportunity of studying the effect on two distinct species of the same genus of isolation side by side on the same island. Here we have on a circumscribed area two species in the course of evolution, the progress of which may be easily studied from time to time. The species having now been described, we may be able in 20 or 30 years' time, by comparing specimens taken then and now, to estimate the amount of change which they will in that time have undergone. It is interesting to note, however, that so far the effect of isolation on the island is not similar in the case of the two species, since apparently the Mouse which must be supposed to have been the longer time at St. Kilda is the very one which has varied in a lesser degree than that which we must regard as an introduction. For *Mus hirtensis*, which appears to have been on St. Kilda since that island was in connection with the mainland, is certainly not much more different from *Mus sylvaticus* than is *Mus muralis* from *Mus musculus*, yet *Mus muralis* can only be an introduced species of at most a few hundred years' standing. Nothing can give stronger emphasis to the fact that different species possess different powers of variability and follow a different course of evolution, so that it seems that we cannot predict what will happen under certain circumstances to one species from our experience of what has happened to another. Every species, it would appear, has its own modes of evolution and development, which are peculiar to it and to it alone.

EXPLANATION OF PLATE IX.

Fig. 1. *Mus hirtensis*, p. 81.
Fig. 2. *Mus muralis*, p. 81.

4. Notes on the Internal Anatomy of *Notornis*. By W. Blaxland Benham, D.Sc., M.A., Professor of Biology, University of Otago, Dunedin, New Zealand.

[Received December 7, 1898.]

Early in August of the present year, 1898, I had the opportunity of examining the anatomy of that rare flightless Rail, *Notornis mantelli*, of which only three previous specimens had been obtained during the last 50 years, so that it has been regarded by European zoologists as probably extinct. Thus Gadow says, in Bronn's 'Thierreich': "kürzlich ausgestorben" (Systematic part, p. 182).

The previous specimens did not reach the hands of naturalists in a condition fit for examination, but this fourth one arrived in a

perfectly fresh condition, and I at once proceeded to examine those parts of the viscera which might have interest to the systematist. As I am not an "ornithologist," and have but little experience in the subject of avian anatomy, it may be that I have omitted to note some special points of importance: for such omissions I must apologize; and as the viscera have been preserved, it may be possible to rectify the omissions at some future time.

The bird was a young female, in which the ovary was very small, none of the eggs being more than one-eighth of an inch in diameter. This fact is of itself of some interest to naturalists, for the sex of the previous specimens had not been determined; and the coloration of this specimen is so similar to that of the skin in the Dresden Museum that there can be no doubt but that it, too, was a female, as also is one of the skins in the British Museum; the other skin appears from Buller's account to be of brighter plumage, and is presumed by him to be a male.

A full account of the colour of *Notornis*, as well as of the history of the previous specimens, will be found in Sir Walter Buller's 'History of the Birds of New Zealand'; and an account of the history of this fourth specimen and the external appearance of this fourth skin was read by me at the meeting of the Otago Institute in September, and will be published in the 'Transactions of the New Zealand Institute' for the current year. In the present paper I confine myself to facts of internal anatomy. The viscera to which I directed my attention were: (*a*) the alimentary tract, (*b*) the tongue, (*c*) the larynx, (*d*) the syrinx. Of all these structures I have made careful measurements and drawings, some of which accompany this paper.

(a) *The Alimentary Tract.*—The œsophagus and glandular stomach present no feature of special interest; the gizzard, of the type usual in graminivorous birds, is of large size, measuring $3\frac{1}{4}$ inches by $2\frac{1}{4}$ inches (the length of the entire bird from the tip of the beak to the tip of the rectrices is 23 inches). The intestine is 48 inches in length from the pylorus up to the cloaca.

The duodenum is $\frac{3}{4}$ inch across, and this loop measures $5\frac{1}{2}$ inches. The intestine is thrown into a few major folds, which are shown in fig. 1 (p. 90). Unfortunately the mesentery had been slightly injured by the taxidermist in removing the viscera, but I believe that the figure is a true representation of the convolutions. I need not describe them in detail, as the figure is sufficiently explicit, and I leave ornithologists to determine the systematic value of the arrangement of these coils, which appear to agree closely with the scheme given by Mitchell for the Rails[1].

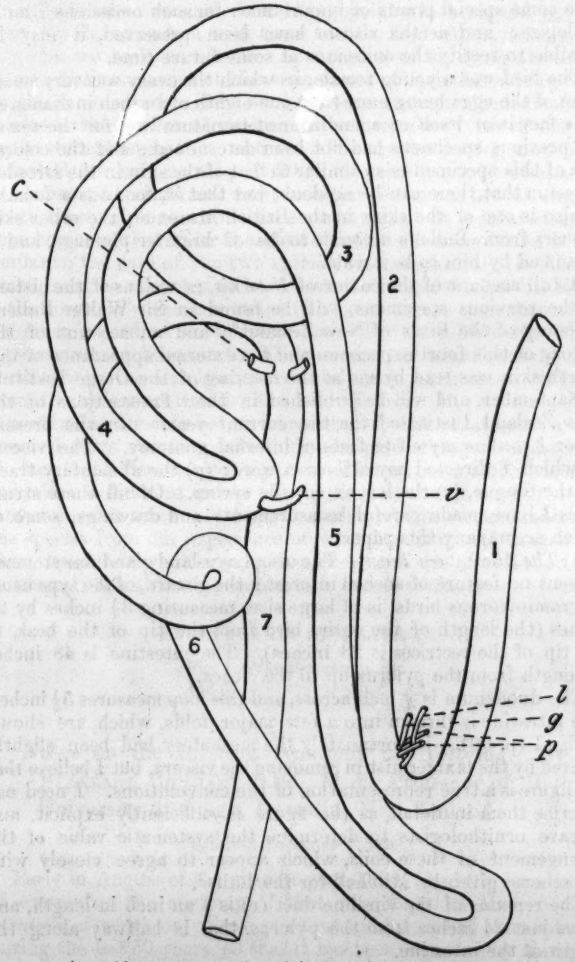
The remains of the vitelline duct (*v*) is $\frac{1}{2}$ an inch in length, and arises just 24 inches from the pylorus, that is halfway along the length of the intestine.

The paired cæca are of large size: they arise (*c*) about 6 inches from the posterior end of the gut, and each measures 9 inches in length. It is at first much narrower than the intestine, and this

[1] Mitchell, Proc. Zool. Soc. 1896, p. 49.

proximal portion is slightly convoluted, but soon dilates to form a wide thin-walled terminal sac.

Fig. 1.



A semidiagrammatic plan of the intestinal coils of *Notornis*.

The loops are numbered: 1, the proximal limb, and 2, the distal limb of the duodenum; 7, the rectum; *c*, origin of cæcum; *g*, entrance of duct from gall-bladder; *l*, duct from liver; *p*, pancreatic ducts; *v*, remains of vitelline stalk.

The gizzard and duodenum were filled with short pieces of sedge (*Carex*) and *Uncinia*.

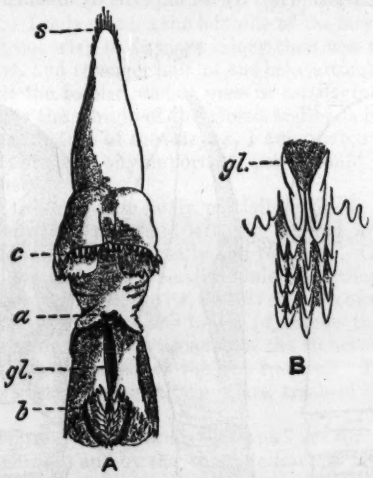
The liver-lobes present the usual inequality. The gall-bladder is an oval sac, completely outside and free from the liver; there are the two usual ducts, one the "cystico-enteric," the other the "hepato-enteric." The pancreas is provided with two ducts, one from the dorsal lobe and the other from the ventral lobe, as we may term those parts which lie on each side of the mesentery, as the duodenum lies spread out in the normal way, though no doubt right or left would be more appropriate.

The ventral lobe of the pancreas terminates anteriorly in a freely projecting finger-like process.

Both the ducts arise at the hinder end of the pancreas, pass directly across the mesentery, to open close to the two liver-ducts into the distal limb of the intestine (fig. 1, *l*, *g*, *p*).

(b) *The Tongue* (fig. 2).—The acute tip of the tongue is beset with a series of short brown cylindrical horny spines (*s*), which

Fig. 2.



A. The tongue and neighbouring parts of the floor of the mouth of *Notornis* (nat. size).

B, enlarged view of the postglottidean longitudinal rows of papillæ.

a, epiglottis; *b*, oblique postglottidean papillæ; *c*, transverse preglottidean papillæ; *gl.*, glottis; *s*, brown apical spines.

are largest at the tip, and decrease in length along the sides, where they soon cease.

At the base of the tongue is a transverse, slightly curved ridge, beset with a series of fourteen hard, conical, white papillæ (*c*) or

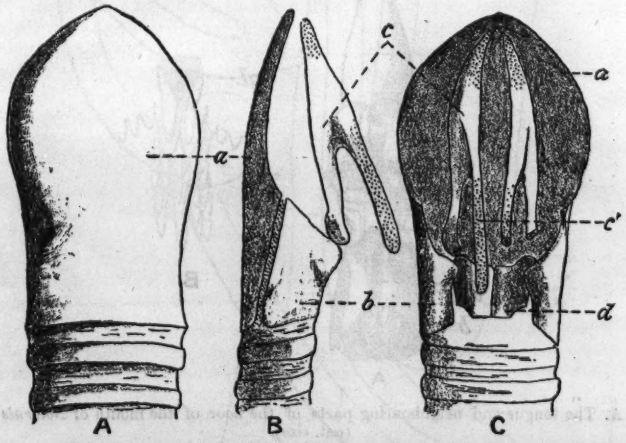
blunt spines, of irregular size, small and large, more or less alternately arranged.

At each end of this transverse row of preglottidean spines the ridge bends sharply downwards vertically, and then curves inwards towards the middle line; it here carries a series of seven similar, but larger, conical papillæ, arranged one above the other, decreasing in size ventrally and ultimately dying out.

The glottis (*gl.*) appears to be provided with a rudimentary "epiglottis" (*a*) in the form of a small rounded nodule of cartilage. Behind the glottis there is on each side a very obliquely placed ridge, carrying a row of about a dozen small postglottidean papillæ (*b*), of which the mediad is the largest. Behind this large papilla is a longitudinal series of postglottidean spines or papillæ of the same character but longer and softer (see fig. 2, B), which are directed backwards, each spine lying above the succeeding one. These are in three rows, a median and two lateral rows. The median row consists of five papillæ; the lateral rows are unsymmetrical, there being on the right two couples and two single papillæ, on the left five couples.

(c) *The Larynx* (fig. 3) is imperfectly ossified and suggests,

Fig. 3.



The skeleton of the larynx of *Notornis* (enlarged).

A, ventral view; B, side view; C, dorsal view: *a*, the so-called "thyroid"; *b*, its posterior incurved portion; *c*, arytenoid; *c'*, its mediad limb supporting the margin of the glottis; *d*, "cricoid." In C the details of the right side are put in for the sake of symmetry; as a matter of fact, I dissected only the left side: the right arytenoid is represented as being cut short so as to show more of the cricoid. The tracheal rings are only diagrammatically indicated, their overlap being omitted. Cartilage is dotted.

as does the ovary, the immaturity of the bird. The so-called "thyroid" (which, according to Gadow, is the "cricoid" of recent authorities) is a nearly flat, somewhat spoon-shaped, plate (*a*), slightly convex ventrally, especially posteriorly; it is feebly pointed in front and truncated behind. The posterior half of its lateral margin is slightly upcurved and forms a cartilaginous ridge, with which is articulated a second bony plate (*b*), which is separated from (*a*) by a narrow cartilaginous area. The posterior piece (*b*) belongs apparently to the "thyroid," with which it becomes continuous, according to Tiedemann and Duméril, in very old birds. The piece *b* curves sharply inwards dorsally, and articulates with the side of a small median bone (*d*), the "cricoid" (or "pro-cricoid" of Fürbringer); it is hexagonal in shape, with the anterior side largest and a groove along the middle; its lateral edge articulates with the incurved margin of the plate *b*, while its antero-lateral angle of each side supports the hinder end of the "arytenoid" (*c*).

The arytenoid is again imperfectly ossified, as is indicated in the figure; it is a Y-shaped bone, with the middle limb directed forwards, and it appears to be here connected with the epiglottis, but of this I am uncertain. I only cleaned the left side of the larynx, as of the syrinx, as I did not wish to do more injury than was necessary.

The main part, and stronger half, of the bone articulates with the "cricoid," while the feebler, and at present cartilaginous, limb (*c'*) of the Y supports the margin of the glottis and ends freely behind.

As to the musculature of the larynx, I am unable to say anything, as I did not think any important point would be presented by its arrangement.

The rings of the *trachea* are only partially ossified; they overlap one another alternately right and left (fig. 4), and are, of course, narrower in the middle line dorsally and ventrally. Overlying this region, on the dorsal line, is a small nodule of cartilage (*x*).

(d) *The Syrinx* (figs. 4–6, pp. 94, 95, 96) consists of seven closely-apposed rings (*a–g*), of which the fourth (*d*) carries the pessulus, so that I presume, from Gadow's account of the structure in general, this ring should be regarded as the last tracheal. If this be the case, then four of the syringeal rings are tracheal and three are bronchial.

The "membrana tympaniformis externa" is supported by the last syringeal ring (*g*) and by the three following bronchial rings (I, II, III).

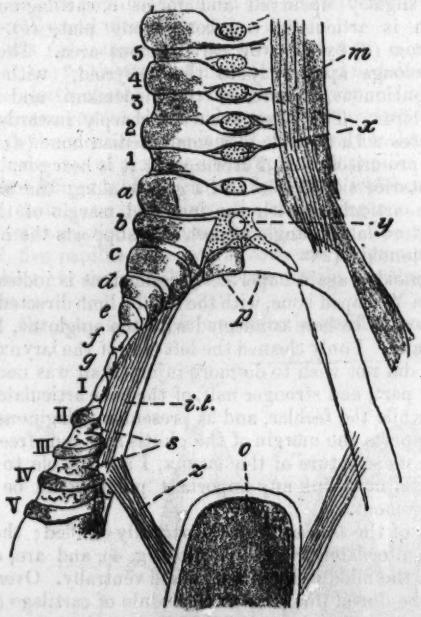
The rings of the syrinx (*a–g*) are in the present specimen separate, owing no doubt to the growth of the bird.

As the arrangement of these rings is unlike anything figured by Gadow in "Bronn," I will describe the syrinx in some detail.

The ring *a* differs little from the preceding normal tracheal ring (1), which, indeed, overlaps it on the right side. The next ring (*b*) is, however, incomplete dorsally, where its end is enlarged and abuts upon a cartilaginous plate, in the centre of which is a small nodule of bone (*y*).

The ring *c* is somewhat larger, and its dorsal ends curve round on to the inner surface of the bronchus and here cease. (Is it therefore a bronchial ring?) On the ventral middle line it is slightly dilated.

Fig. 4.



The syrinx of *Notornis*, dorsal view (× 8).

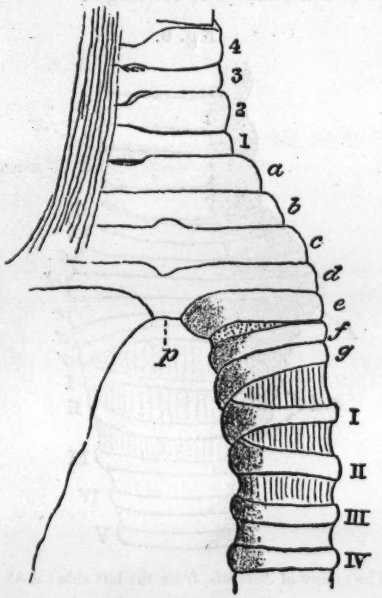
a–*g*. The modified rings of the syrinx; 1–5, normal tracheal rings; I to V, normal bronchial rings; *i.t.*, membrana tympaniformis interna; *m*, tracheo-bronchial muscle; *o*, portion of œsophagus; *p*, origin of pessulus; *s*, *x*, accessory interannular cartilaginous nodules; *y*, ossicle; *z*, muscle from œsophagus to bronchus.

The fourth syringeal ring (*d*), when seen from the side, passes straight across, and lies almost horizontally. It has a greater diameter than the preceding, and projects as a knob ventrally. Here it is produced backwards (*p*) and is continued dorsally between the two bronchi to form the pessulus. But the dorsal end of this same ring (*d*) curves round the bronchus on each side as *c* does, and, like it, ceases against the "membrana tympaniformis interna."

The pessulus, which is directly connected with the ring *d* at its ventral end, terminates dorsally against a couple of bones situated at the angle formed by the two bronchi, which appear

to be independent of any ring, and present a concavity on their outer faces. It is, however, possible that when ossification is complete these two bones will ankylose with the ends of the ring *b*.

Fig. 5.



The syrinx of *Notornis*, ventral view (slightly more enlarged than fig. 4). Letters as in fig. 4.

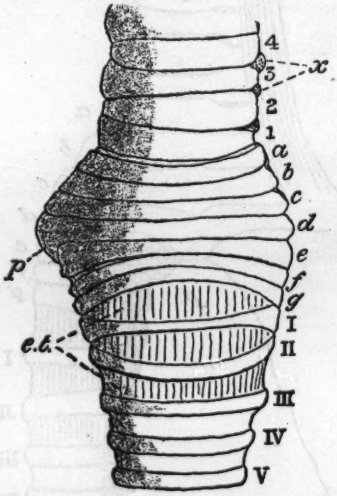
The remaining syringeal rings (*e*, *f*, *g*) call for little remark. They are all closely apposed, and ventrally curve very sharply round the bronchus to reach the membrana tympaniformis interna, while dorsally the incurved region is very slight.

The ring *g*, owing to its curvature, is much arched forwards at the side, so that between it and the first unmodified bronchial (I) there is a considerable space, across which is stretched the membrana tympaniformis externa. This ring (I) is almost straight, while II is concave upwards; between them is also the thin membrane: another part of it lies between II and III, but this space is much narrower than either of the preceding. On the dorsal side between the ends of each of the rings II/III and III/IV is a small ossicle (*s*).

Passing from the syrinx itself, I would refer to a slip of muscle

which does not appear to be mentioned by Gadow; that is, a bundle (*z*) which passes from the hinder part of the membrana tympaniformis interna to the œsophagus. I cannot distinguish a "bronchiodesmus," unless this is some modification of it. The only muscle on the outer surface of the syrinx is the "tracheobronchialis," which is attached to the ring *d*.

Fig. 6.



The syrinx of *Notornis*, from the left side (× 8).

e.t., membrana tympaniformis externa. Other letters as in fig. 4.

A comparison of the syrinx with the figures given by Gadow in Bronn's 'Thierreich,' as well as with those described from time to time by Beddard, shows that in this particular *Notornis* is very peculiar.

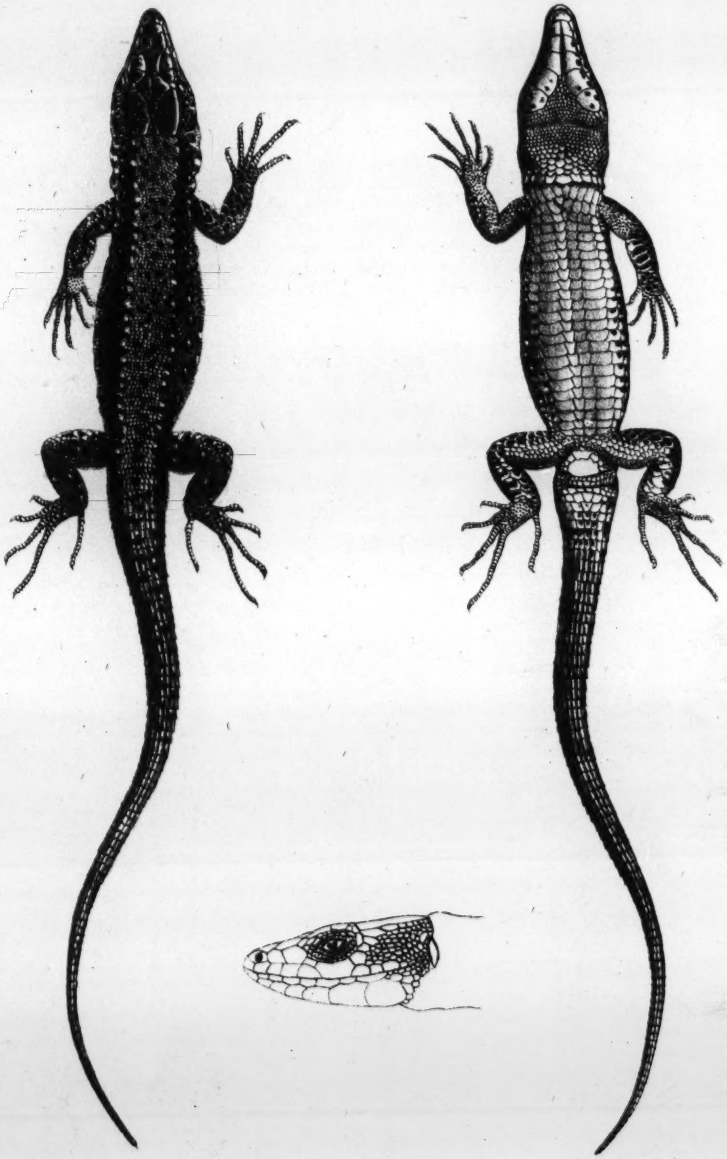
5. Descriptions of two new Lizards from the Interior of British East Africa. By G. A. Boulenger, F.R.S.

[Received January 6, 1899.]

(Plate X.)

Lacerta jacksoni. (Plate X.)

Head rather long, much depressed. Rostral not entering the nostril; a single postnasal; four upper labials anterior to the subocular; a series of granules between the supraoculars and the supraciliaries; occipital moderate, a little shorter than the inter-



P.J. Smit lith.

West, Newman imp

LACERTA JACKSONI.

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parietal; temple granular, with a feebly enlarged tympanic plate. A distinct gular fold; 25 gular scales on a line between the collar and the third pair of chin-shields; collar even-edged, composed of 10 plates. Dorsal scales rhomboidal, keeled, juxtaposed or subimbricate; laterals a little smaller; 40 scales across the middle of the body; 2 or 3 lateral scales correspond to the length of a ventral plate. Ventrals tetragonal, broader than long, in 8 longitudinal and 24 transverse series; the plates of the series next to the median nearly twice as broad as the one on the inner side and once and a half the one on the outer side; the outermost plates very small. Præanal with a large plate in front of it. The hind limb reaches the collar-fold. Scales on upper surface of tibia smaller than dorsals. Femoral pores 16–17. Upper caudal scales strongly keeled, with truncate or obtusely pointed posterior border. Brown above, darker on the sides, which are stellate with small white, black-edged ocelli; upper surface of head and back with small black spots; a large black spot on each upper labial; uniform whitish beneath.

	millim.		millim.
Total length	175	From end of snout to vent.....	70
Head	19	Fore limb	26
Width of head	12	Hind limb	37
From end of snout to fore limb.....	29	Tail (reproduced) ..	105

A single male specimen from 'Ravine Station,' Mau Mountains, on the main route from Mombasa to Lake Victoria, at an altitude of 7500 feet, was presented to the British Museum by Mr. F. J. Jackson, C.B.

The discovery of a *Lacerta* allied to *L. muralis* in tropical Africa is one of very great interest. So far, this essentially Palæarctic genus was represented south of the Atlas by a single somewhat aberrant species, *L. echinata* Cope, from the coast of Guinea.

The same collection has yielded three specimens of a Lizard for which I propose the name of

CHAMÆSAURA ANNECTENS.

It connects *C. didactyla* Blgr., with which it agrees in the shape and proportions of the head and body and the didactyle hind limb, with *C. tenuior* Gthr., by having only 24 scales round the body and a single femoral pore. 37 to 39 transverse rows of scales between the occiput and the base of the tail. Yellowish or pale brownish, with four pale brown stripes, the median pair edged with black on the outer side; lower surface of head and body white.

	millim.		millim.
Total length	45	Fore limb	45
Head	17	Hind limb	9
Width of head	8	Tail (reproduced) ..	300

The extreme forms of this genus are shown to be more and

more connected as our knowledge progresses, a state of things that is best expressed by a synopsis of the 7 species which are now distinguished:—

A. Both pairs of limbs very distinct.

Hind limb pentadactyle;	28	scales round the body	.....	1.	*ænea* Wgm.
„ didactyle;	26	„ „	.....	2.	*didactyla* Blgr.
„ „	24	„ „	.....	3.	*annectens* Blgr.
„ monodactyle;	26	„ „	.....	4.	*anguina* L.
„ „	24	„ „	.....	5.	*tenuior* Gthr.

B. Fore limb very minute or absent; hind limb monodactyle.

Fore limb distinct;	26	scales round the body	.....	6.	*miopropus* Blgr.
„ absent;	22	„ „	.....	7.	*macrolepis* Cope.

EXPLANATION OF PLATE X.

Lacerta jacksoni, p. 96. Upper and lower views and side view of head.

6. A Revision of the African and Syrian Fishes of the Family *Cichlidæ*.—Part II.[1] By G. A. Boulenger, F.R.S., F.Z.S.

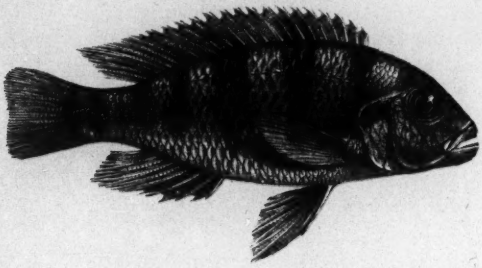
[Received January 6, 1899.]

(Plates XI. & XII.)

When I had the honour of reading the first part of this paper before this Society, nearly a year ago, I could not have foreseen the enormous additions to our knowledge of the genera and species of African *Cichlidæ* which were so soon to follow through the examination of the collections made in Lake Tanganyika by Mr. Moore, and in the Congo by the Officers in the service of the Congo Free State. The Tanganyika forms have been described in the 'Transactions' of this Society (vol. xv. pt. 1, 1898), the Congo forms are being published in the 'Annales du Musée du Congo.'

In the first part I distinguished 9 genera and diagnosed 33 species of the first 6 genera, reserving for the second part the definitions of the species of the genera *Tilapia*, *Docimodus*, and *Paretroplus*. The additions to which I have alluded necessitate an alteration in this plan, and in order to bring my account up to date I have decided to prepare a new synopsis of the genera, amounting now to 19 instead of 9, and to enumerate all the species of the genera previously dealt with by me, with a mere reference to the first part or to the 'Transactions' paper in which the Tanganyika forms have been described and figured.

[1] *Cf.* P. Z. S. 1898, p. 132.



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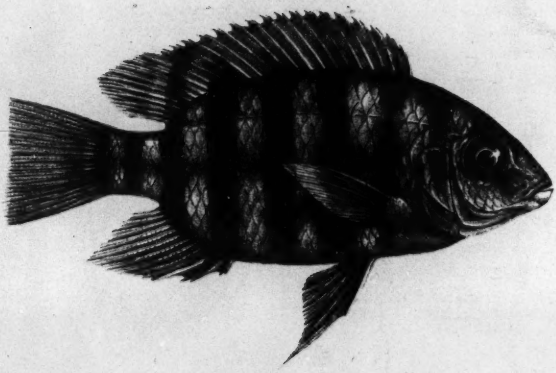
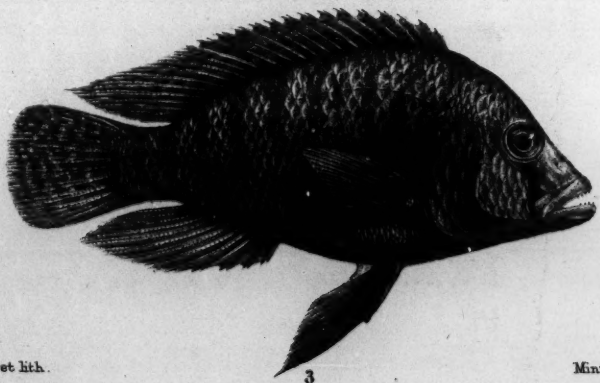


1



3

J.Green del. et lith. Mintern Bros. imp

1.TILAPIA MARIÆ 2.T.LIVINGSTONII. 3.T.DESFONTAINESII.

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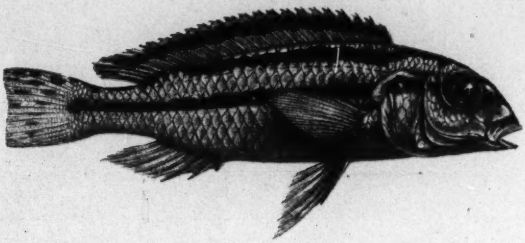
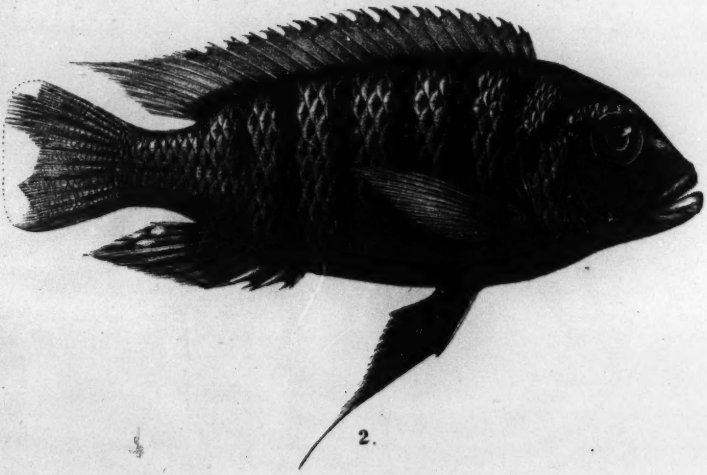
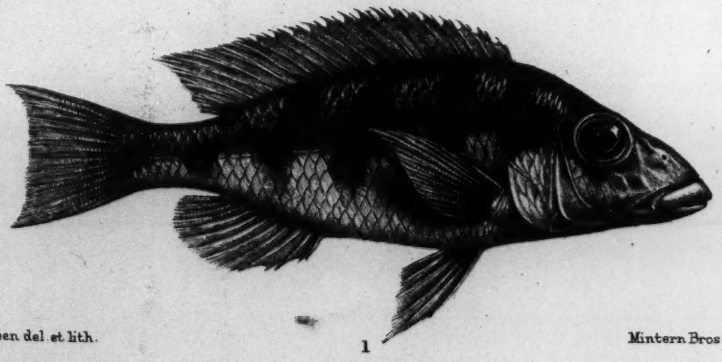


3



2.



1

J.Green del. et lith. Mintern Bros. imp.

1.TILAPIA ROSTRATA. 2.T. ZEBRA. 3.T. AURATA.

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Synopsis of the Genera.

I. No sheath to the vertical fins.

A. Anal spines V to X; teeth conical, at least in the outer row.

Jaws with a band of very small conical teeth, with moderately enlarged canines in front ..... 1. *Lamprologus* Schilth.

Jaws with a band of very small conical teeth, with a few curved canines in front, the outer of which are very large and tusk-like ..... 2. *Julidochromis* Blgr.

Jaws with a series of conical teeth followed by a broad band of minute tricuspid teeth ..... 3. *Telmatochromis* Blgr.

B. Anal spines III; teeth not notched, unicuspid, numerous.

1. Teeth conical or fang-like; alveolar surface of jaws narrow or moderately broad.

a. No pad-like papillose prominence close to the upper part of the branchial arches.

Teeth in one or two series, with more or less enlarged or canine-like ones at the symphysis..... 4. *Hemichromis* Ptrs.

Teeth in two or more series, outer longest and more or less curved inward; anal with 6 to 12 soft rays ..... 5. *Paratilapia* Blkr.

Several rows of fang-like teeth; scales small and irregular; anal with 16 soft rays..... 6. *Bathybates* Blgr.

Teeth in two series; outer mandibular teeth pointing outwards, perpendicular to the others ..... 7. *Ectodus* Blgr.

b. A pad-like prominence close to the upper part of the branchial arches.

Teeth in two or more series, outer largest and more or less distinctly curved inward ..... 8. *Pelmatochromis* Stdr.

Teeth in one or two series, some of the larger ones with the crown bent at an angle to the shaft and directed forward or backward ..... 9. *Chromidotilapia* Blgr.

2. Teeth not conical.

Alveolar surface of jaws extremely broad, with innumerable minute teeth with compressed, oblique crowns ..... 10. *Corematodus* Blgr.

Jaws with rather large spatulate teeth with truncated crowns disposed in oblique transverse rows of two or three ..... 11. *Eretmodus* Blgr.

C. Anal spines VI; jaws with bands of minute tricuspid teeth, an outer row of bicuspid teeth, and enlarged conical teeth at the sides of the præmaxillary ..... 12. *Tropheus* Blgr.

D. Anal spines III or IV; teeth all or part notched or bi- or tricuspid, in two or more rows.

Jaws with broad bands of minute bicuspid teeth, with an outer series of larger bicuspid teeth, and a single series of sharply differentiated conical teeth at the sides of the præmaxillary ..... 13. *Simochromis* Blgr.

Alveolar surface of jaws narrow or moderately broad, all or most of the outer teeth bi- or tricuspid ..... 14. *Tilapia* Smith.

Alveolar surface of jaws narrow, with two series of notched teeth; a pair of enlarged, incisor-like teeth at the symphysis; an adipose crest on the occiput ..... 15. *Steatocranus* Blgr.

Alveolar surface of jaws very broad; outer teeth large, with nail-shaped entire crowns, those of the inner rows tricuspid ..... 16. *Docimodus* Blgr.

E. Anal spines III; teeth large, few, in a single series.

Teeth with swollen bases and low, compressed, slightly notched crowns ..... 17. *Perissodus* Blgr.

Teeth compressed and truncate, curved and directed backwards ..... 18. *Plecodus* Blgr.

II. Vertical fins folding in a scaly sheath; anal spines VIII to X; teeth obtuse, in a single row ..... 19. *Paretroplus* Blkr.

1. LAMPROLOGUS Schilth.
P. Z. S. 1898, p. 134.

1. LAMPROLOGUS FASCIATUS Blgr.
Tr. Z. S. xv. p. 7.

Lake Tanganyika.

2. LAMPROLOGUS COMPRESSICEPS Blgr.
Tr. Z. S. xv. p. 7.

Lake Tanganyika.

3. LAMPROLOGUS MOORII Blgr.
Tr. Z. S. xv. p. 8.

Lake Tanganyika.

4. LAMPROLOGUS CONGOENSIS Schilth.
P. Z. S. 1898, p. 134.

Congo.

5. LAMPROLOGUS MODESTUS Blgr.
Tr. Z. S. xv. p. 8.

Lake Tanganyika.

6. LAMPROLOGUS ELONGATUS Blgr.
Tr. Z. S. xv. p. 9.

Lake Tanganyika.

7. LAMPROLOGUS FURCIFER Blgr.
Tr. Z. S. xv. p. 9.

Lake Tanganyika.

2. JULIDOCHROMIS Blgr.
Tr. Z. S. xv. p. 11.

1. JULIDOCHROMIS ORNATUS Blgr.
Tr. Z. S. xv. p. 12.

Lake Tanganyika.

3. TELMATOCHROMIS Blgr.
Tr. Z. S. xv. p. 10.

1. TELMATOCHROMIS VITTATUS Blgr.
Tr. Z. S. xv. p. 10.

Lake Tanganyika.

2. TELMATOCHROMIS TEMPORALIS Blgr.
Tr. Z. S. xv. p. 11.

Lake Tanganyika.

4. HEMICHROMIS Peters.
P. Z. S. 1898, p. 134.

1. HEMICHROMIS FASCIATUS Peters.
P. Z. S. 1898, p. 135.

West Africa.

2. HEMICHROMIS BIMACULATUS Gill.
P. Z. S. 1898, p. 135.

North and West Africa.

3. HEMICHROMIS ? ANGOLENSIS Stdr.
P. Z. S. 1898, p. 136.

Angola.

5. PARATILAPIA Blkr.
P. Z. S. 1898, p. 137.

1. PARATILAPIA POLLENI Blkr.
P. Z. S. 1898, p. 138.

Madagascar.

2. PARATILAPIA BLEEKERI Sauv.
P. Z. S. 1898, p. 139.

Madagascar.

3. PARATILAPIA TYPUS Blkr.
P. Z. S. 1898, p. 139.

Madagascar.

4. PARATILAPIA SACRA Gthr.
P. Z. S. 1898, p. 139.

Lake of Galilee.

5. PARATILAPIA LONGIROSTRIS Hilgend.
P. Z. S. 1898, p. 140.

Lake Victoria Nyanza.

6. PARATILAPIA MOFFATI Casteln.
P. Z. S. 1898, p. 140.

S.E. Africa.

7. Paratilapia robusta Gthr.
P. Z. S. 1898, p. 141.
Lake Nyassa; Zambesi.

8. Paratilapia cavifrons Hilgend.
P. Z. S. 1898, p. 141.
Lake Victoria Nyanza.

9. Paratilapia retrodens Hilgend.
P. Z. S. 1898, p. 142.
Lake Victoria Nyanza.

10. Paratilapia afra Gthr.
P. Z. S. 1898, p. 142.
Lake Nyassa.

11. Paratilapia bloyeti Sauv.
P. Z. S. 1898, p. 143.
East Africa.

12. Paratilapia serranus Pfeff.
P. Z. S. 1898, p. 143.
Lake Victoria Nyanza; German East Africa.

13. Paratilapia schwebischii Sauv.
P. Z. S. 1898, p. 144.
Upper Ogowe.

14. Paratilapia modesta Gthr.
P. Z. S. 1898, p. 144.
Lake Nyassa and Shiré River.

15. Paratilapia livingstonii Gthr.
P. Z. S. 1898, p. 145.
Lake Nyassa and Shiré River.

16. Paratilapia intermedia Gthr.
P. Z. S. 1898, p. 145.
Lake Nyassa and Shiré River.

17. Paratilapia pfefferi Blgr.
Tr. Z. S. xv. p. 12.
Lake Tanganyika.

18. Paratilapia macrops Blgr.
Tr. Z. S. xv. p. 13.
Lake Tanganyika.

19. Paratilapia dimidiata Gthr.
P. Z. S. 1898, p. 145.
Lake Nyassa and Shiré River.

20. PARATILAPIA LONGICEPS Gthr.
P. Z. S. 1898, p. 146.

Lake Nyassa and Shiré River.

21. PARATILAPIA VENTRALIS Blgr.
Tr. Z. S. xv. p. 13.

Lake Tanganyika.

22. PARATILAPIA FURCIFER Blgr.
Tr. Z. S. xv. p. 14.

Lake Tanganyika.

23. PARATILAPIA LEPTOSOMA Blgr.
Tr. Z. S. xv. p. 14.

Lake Tanganyika.

6. BATHYBATES Blgr.
Tr. Z. S. xv. p. 15.

1. BATHYBATES FEROX Blgr.
Tr. Z. S. xv. p. 15.

Lake Tanganyika.

7. ECTODUS Blgr.
Tr. Z. S. xv. p. 21.

1. ECTODUS DESCAMPSII Blgr.
Tr. Z. S. xv. p. 21.

Lake Tanganyika.

2. ECTODUS MELANOGENYS Blgr.
Tr. Z. S. xv. p. 21.

Lake Tanganyika.

8. PELMATOCHROMIS Stdr.
P. Z. S. 1898, p. 147.

1. PELMATOCHROMIS BUETTIKOFERI Stdr.
P. Z. S. 1898, p. 147.

Liberia.

2. PELMATOCHROMIS JENTINKI Stdr.
P. Z. S. 1898, p. 148.

Liberia.

3. PELMATOCHROMIS LATERALIS Blgr.
P. Z. S. 1898, p. 148.

Congo.

4. PELMATOCHROMIS CONGICUS Blgr.
P. Z. S. 1898, p. 149.

Congo.

5. PELMATOCHROMIS OCELLIFER, sp. n.

3 series of teeth in both jaws. Depth of body $2\frac{1}{3}$ in total length, length of head $2\frac{2}{3}$. Snout as long as eye, which is $3\frac{1}{2}$ times in length of head and equals interorbital width; maxillary extending to below anterior border of eye; 3 series of scales on the cheek; opercule naked. Gill-rakers very short, 7 on lower part of anterior arch. Dorsal XV 10; spines subequal from the fifth, a little more than $\frac{1}{2}$ length of head; middle soft rays produced into filaments. Pectoral $\frac{3}{4}$ length of head. Ventral with produced outer rays, reaching anal spines. Anal III 8; third spine slightly shorter than longest dorsals. Caudal rounded. Caudal peduncle deeper than long. Scales cycloid, $29\frac{2\frac{1}{2}}{10}$; lat. l. $\frac{19}{8-9}$. Olive above, yellowish beneath; five dark olive bars, much broader than the spaces between them; a blackish opercular spot; dorsal with blackish spots and a large blackish, light-edged ocellus on the last spines and the anterior soft rays; ventrals, anal, and caudal blackish.

Total length 85 millim.

A single specimen from Monsembé, Upper Congo. Presented to the British Museum by the Rev. J. H. Weeks.

6. PELMATOCHROMIS WELWITSCHI Blgr.
P. Z. S. 1898, p. 149.

Angola.

7. PELMATOCHROMIS GUENTHERI Sauv.
P. Z. S. 1898, p. 150.

Gold Coast.

8. PELMATOCHROMIS SUBOCELLATUS Gthr.
P. Z. S. 1898, p. 150.

Gaboon.

9. CHROMIDOTILAPIA Blgr.
P. Z. S. 1898, p. 151.

1. CHROMIDOTILAPIA KINGSLEYÆ Blgr.
P. Z. S. 1898, p. 151.

Gaboon, Ogowe.

2. CHROMIDOTILAPIA (?) FREDERICI Casteln.
P. Z. S. 1898, p. 151.

Lake Ngami.

10. COREMATODUS Blgr.
P. Z. S. 1898, p. 152.

1. COREMATODUS SHIRANUS Blgr.
P. Z. S. 1898, p. 152.

Upper Shiré River.

11. Eretmodus Blgr.
Tr. Z. S. xv. p. 16.

1. Eretmodus cyanostictus Blgr.
Tr. Z. S. xv. p. 16.

Lake Tanganyika.

12. Tropheus Blgr.
Tr. Z. S. xv. p. 17.

1. Tropheus moorii Blgr.
Tr. Z. S. xv. p. 18.

Lake Tanganyika.

13. Simochromis Blgr.
Tr. Z. S. xv. p. 19.

1. Simochromis diagramma Gthr.
Tr. Z. S. xv. p. 19.

Lake Tanganyika.

14. Tilapia.

Tilapia, Smith, Ill. Zool. S. Afr., Fish. (1840).
Sarotherodon, Rüpp. Verz. Mus. Senck. iv. p. 21 (1852); Günth. Cat. iv. p. 273 (1862).
Coptodon, Gervais, Bull. Soc. Agric. Hérault, 1853, p. 81.
Haligenes, Günth. Proc. Zool. Soc. 1859, p. 471.
Chromis, Günth. Cat. iv. p. 267.
Ptychochromis, Steind. Sitzb. Ak. Wien, lxxxii. i. 1880, p. 248.
Haplochromis, Hilgend. Sitzb. Ges. naturf. Fr. Berl. 1888, p. 76.
Oreochromis, Günth. Proc. Zool. Soc. 1889, p. 70.
Ctenochromis, Pfeff. Jahrb. Hamb. wiss. Anst. x. 1893, p. 149.

Body short or moderately elongate; scales cycloid or ctenoid. Two or more series of small teeth in the jaws, all or greater part notched or bi- or tricuspid. Maxillary entirely concealed under the præorbital when the mouth is closed, or a small portion of its distal extremity exposed. Dorsal with 13 to 19 spines, anal with 3 or 4. Vertebræ 28–32 (14–17+13–16)[1].

Numerous species, from Syria, Africa, and Madagascar.

[1] 17+15=32 in *T. nilotica*.
17+15=32 in *T. galilæa*.
15+13=28 in *T. lata*.
15+16=31 in *T. desfontainesi*.
14+14=28 in *T. oligacanthus*.

In four of these species the third vertebra bears a very strong hæmal process. The process is very feeble in *T. desfontainesi*.

Synopsis of the Species.

I. Scales cycloid, without marginal denticulation; third anal spine not longer than longest dorsal spine.

A. Gill-rakers 15 to 25 on lower part of anterior arch; 2 or 3 series of scales on the cheek.

1. Anal spines 4; pectoral not longer than head, not extending to origin of anal; dorsal XV–XVII 10–12.

Teeth in 7 or 8 series; caudal peduncle a little longer than deep; maxillary extending to between nostril and eye; diameter of eye 5 times in length of head; Sq. $35\frac{5}{15}$ ..... 1. *hunteri* Gthr.

Teeth in 4 or 5 series; caudal peduncle slightly deeper than long; maxillary extending nearly to below anterior border of eye; diameter of eye 5 to $5\frac{1}{2}$ times in length of head; Sq. $32\frac{3-4}{13}$ ..... 2. *nigra* Gthr.

Teeth in 5 to 7 series; caudal peduncle not longer than deep; maxillary extending to between nostril and eye; diameter of eye 4 to $4\frac{1}{2}$ times in length of head; Sq. $31–32\frac{3}{13}$ ..... 3. *shirana* Blgr.

B. Anal spines 3 (exceptionally 4 in *T. mossambica*).

1. Dorsal XV–XVIII 10–14; pectoral extending to origin of anal or beyond.

a. Caudal rounded, the membrane between the rays scaleless, except at the base.

Pectoral not longer than head; mouth large, nearly as broad as head; Sq. $30–33\frac{3\frac{1}{2}-4\frac{1}{2}}{13–15}$ ..... 4. *mossambica* Ptrs.

Pectoral at least as long as head; mouth $\frac{1}{2}$ to $\frac{2}{3}$ width of head; Sq. $31–35\frac{4–5}{14–15}$ ..... 5. *nilotica* L.

b. Caudal truncate or slightly emarginate; pectoral at least as long as head.

α. Caudal peduncle at least as long as deep.

Sq. $32–33\frac{4}{19–20}$; lat. l. $\frac{14–18}{8–12}$; dorsal spines equal in length from the sixth ..... 6. *tanganicæ* Gthr.

Sq. $31–34\frac{3\frac{1}{2}-4\frac{1}{2}}{14–15}$; lat. l. $\frac{19–21}{12–17}$; last dorsal spine longest. 7. *natalensis* M. Web.

β. Caudal peduncle deeper than long.

* Maxillary not extending to below anterior border of eye.

† Sq. $31–34\frac{3\frac{1}{2}}{14–15}$; mouth not more than half as broad as head ..... 8. *galilæa* Hasselq.

†† Sq. $28–30\frac{2\frac{1}{2}-3}{11–12}$.

Depth of body much greater than length of head; last dorsal spine longest ..... 9. *microcephala* Blkr.

Depth of body not much greater than length of head; last dorsal spine longest ..... 10. *macrocephala* Blgr.

Depth of body much greater than length of head; dorsal spines nearly equal in length from the sixth. 11. *nigripinnis* A. Dum.

** Maxillary extending to below anterior border of eye; depth of body equal to length of head; Sq. 30–31 $\frac{3-3\frac{1}{2}}{10}$. 12. *dumerili* Stdr.

c. Caudal rounded, densely scaled; dorsal with 9 or 10 soft rays; Sq. 29–30 $\frac{3-3\frac{1}{2}}{13}$. 13. *lepidura* Blgr.

d. Caudal emarginate, upper corner pointed, lower rounded and shorter; dorsal spines subequal from the middle ones; caudal peduncle a little longer than deep; Sq. 32–35 $\frac{3\frac{1}{2}}{15-16}$ ..... 14. *squamipinnis* Gthr.

2. Dorsal XIV 10–14.

Anal III 10; 3 series of scales on cheek ..... 15. *macrocentra* A. Dum.
Anal III 10; 2 series of scales on cheek ..... 16. *pleuromelas* A. Dum.
Anal III 7; 3 series of scales on cheek ..... 17. *heudeloti* A. Dum.

B. Gill-rakers 8 to 14 on lower part of anterior arch.

1. Dorsal with not more than 16 spines.

a. Pectoral not extending to vertical of origin of anal.

a. Caudal rounded or truncate; not produced at the angles; pectoral not longer than head.

* 2 series of scales on cheek; D. XIII–XV 9–11; A. III 9; Sq. 27–29 $\frac{2\frac{1}{2}-3}{9-10}$ ..... 18. *sparrmani* Smith.

** 3 or 4 series of scales on cheek; Sq. 29–32 $\frac{3-3\frac{1}{2}}{10-17}$.

† Dorsal XIII–XV 9–13; A. III 7–9.

Maxillary extending a little beyond vertical of anterior border of eye ..... 19. *ovalis* Stdr.
Maxillary extending to below anterior border of eye; width of mouth $\frac{1}{3}$ to $\frac{1}{4}$ width of head ..... 20. *menzalensis* Mitch.
Maxillary extending to below anterior border of eye; width of mouth $\frac{1}{3}$ to $\frac{1}{3}$ width of head ..... 21. *zillii* Gerv.
Maxillary extending to between nostril and eye; width of mouth $\frac{1}{3}$ to $\frac{1}{3}$ width of head ..... 22. *magdalenæ* Lort.

†† D. XVI 8–13.

‡ Depth of body greater than length of head.

Dorsal with 8 soft rays, anal with 9; caudal rounded. 23. *tholloni* Sauv.
Dorsal with 12 or 13 soft rays, anal with 10 or 11; caudal rounded ..... 24. *cabræ* Blgr.
Dorsal with 12 soft rays; anal with 10; caudal truncate ..... 25. *mariæ* Blgr.

‡‡ Length of head greater than depth of body; dorsal with 8 or 9 soft rays, anal with 6 or 7; caudal rounded, subtruncate ..... 26. *horii* Gthr.

*** 5 series of scales on the cheek; D. XIV 11; A. III 10.

Last dorsal spine longest; Sq. 25–26 $\frac{4}{\times}$ ..... 27. *melanopleura* A. Dum.
Dorsal spines subequal from the 5th; Sq. 29 $\frac{4}{13}$ ... 28. *cæruleomaculata* [Roch.

**** 6 or 7 series of scales on the cheek; D. XV 10; A. III 8.

Sq. 33 $\frac{3}{8}$; dorsal spines subequal from the 5th..... 29. *jallæ* Blgr.

Sq. 30 $\frac{5}{12}$; last dorsal spine longest ..... 30. *humilis* Stdr.

β. Caudal produced at the angles; pectoral a little longer than head; 2 series of scales on the cheek; D. XV–XVI 11–12; A. III 9; Sq. 31 $\frac{3}{11}$ .... 31. *guineensis* Blkr.

b. Pectoral extending to vertical of origin of anal, or beyond.

a. 3 or 4 series of scales on the cheek; dorsal with no more than 14 soft rays.

* Pectoral at least as long as head; D. XV–XVI 9–14; A. III 8–10.

† Depth of body nearly equal to length of head.

Soft dorsal much prolonged, with 12 or 13 rays; Sq. 28–31 $\frac{4}{12}$ ..... 32. *vorax* Pfeff.

Soft dorsal not prolonged, with 9 or 10 soft rays; Sq. 30–32 $\frac{3\frac{1}{2}}{15}$ ..... 33. *simonis* Gthr.

†† Depth of body much greater than length of head.

Caudal truncate or slightly emarginate; Sq. 29–31 $\frac{2\frac{1}{2}-3\frac{1}{2}}{11-13}$ ..... 34. *lata* Gthr.

Caudal truncate; Sq. 26 $\frac{3\frac{1}{2}}{\times}$ .... 35. *rangii* A. Dum.

Caudal rounded; Sq. 30–32 $\frac{3}{12-13}$; 4 series of scales on the cheek; maxillary not extending quite to below anterior border of eye ..... 36. *rendalli* Blgr.

Caudal rounded; Sq. 32 $\frac{3-3\frac{1}{2}}{10}$; 3 series of scales on the cheek; maxillary extending to below anterior border of eye .... 37. *affinis* A. Dum.

** Pectoral shorter than head; D. XIV 11; A. III 9; Sq. 29 $\frac{3-3\frac{1}{2}}{11}$ ..... 38. *burtoni* Gthr.

β. 5 or 6 series of scales on the cheek; D. XIV–XV 15–16; A. III 10–11; Sq. 29–30 $\frac{4-5}{10-12}$ ..... 39. *buettikoferi* Hubr.

2. D. XVIII 8; A. III 7; caudal rounded ... 40. *polycentra* A. Dum.

II. Scales mostly with marginal denticulation.

A. Third anal spine not longer than longest dorsal spine.

1. Dorsal with 13 to 17 spines.

a. Pectoral extending as far as vertical of origin of anal; 3 or 4 series of scales on the cheek.

a. Sq. 32–34 $\frac{3-4\frac{1}{2}}{10-13}$.

* Maxillary extending to between nostril and eye; caudal peduncle longer than deep.

Caudal truncate or feebly emarginate; 11 or 12 gill-rakers on lower part of anterior arch..... 41. *kirki* Gthr.

Caudal with crescentic emargination; 8 or 9 gill-rakers on lower part of anterior arch..... 42. *lethrinus* Gthr.

Caudal slightly notched, pointed above, rounded below; 11 or 12 gill-rakers on lower part of anterior arch ..... 43. *johnstoni* Gthr.

** Maxillary extending nearly to below anterior border of eye; caudal peduncle as long as deep ..... 44. *pectoralis* Pfeff.

β. Sq. 28–31 $\frac{6-7}{11-12}$; maxillary extending to below anterior border of eye or a little beyond ..... 45. *nuchisquamulata* [Hilg.

b. Pectoral not extending to origin of anal.

α. Sq. 35 $\frac{4-5}{14}$; 21 gill-rakers on lower part of anterior arch; caudal rather deeply emarginate; caudal peduncle 1½ as long as deep..... 46. *rostrata* Blgr.

β. Sq. 31 $\frac{5-7}{13}$; 10 gill-rakers on lower part of anterior arch; caudal rounded; caudal peduncle slightly longer than deep ..... 47. *williamsi* Gthr.

γ. Sq. 29–33 $\frac{3-5}{11-16}$; 8–10 gill-rakers on lower part of anterior arch; caudal peduncle as long as deep or a little deeper than long.

* Maxillary extending to below anterior border of eye; Sq. 30–33 $\frac{3-4}{11-12}$.

3 or 4 series of scales on the cheek; last dorsal spine longest..... ..... 48. *calliptera* Gthr.

4 or 5 series of scales on the cheek; dorsal spines subequal from the 5th ..... 49. *monteiri* Blgr.

** Maxillary extending to between nostril and eye; Sq. 29–30 $\frac{3-4}{11-12}$.

3 or 4 series of scales on the cheek; dorsal spines equal in length from the 4th or 5th ..... 50. *fasciata* Perugia.

4 or 5 series of scales on the cheek; last dorsal spine longest ..... 51. *acuticeps* Stdr.

*** Maxillary extending to below anterior border of eye; Sq. 30–33 $\frac{4-6}{12-16}$.

Teeth in 6 series; upper profile of snout curved ..... 52. *livingstonii* Blgr.

Teeth in 3 series; upper profile of snout straight..... 53. *desfontainesi* Lacép.

δ. Sq. 26–28 $\frac{2\frac{1}{2}-3}{11-13}$; 8 gill-rakers on lower part of anterior arch; caudal rounded; caudal peduncle as long as deep.

Last dorsal spine longest; anal with 7 soft rays ..... 54. *flavii-josephi* Lort.

Dorsal spines subequal from the 3rd; anal with 8 to 10 soft rays..... 55. *philander* M. Web.

2. Dorsal with 18 or 19 spines.

D. XVIII 10; A. III 6–7; Sq. 33–35 $\frac{5-6}{12-13}$; lips produced into long pointed lobes ..... 56. *labiata* Blgr.

D. XVIII 8; A. III 8; Sq. 31 $\frac{6-7}{16}$..... 57. *zebra* Blgr.

D. XIX 6; A. III 6; Sq. 34 $\frac{5-6}{12}$ ..... 58. *aurata* Blgr.

B. Third anal spine longer than longest dorsal spine.

1. Head 2⅔ to 3 times in total length; D. XIII–XIV 10–13; A. III 7–9.

a. Soft dorsal rays much shorter than head;

Sq. 32–34 $\frac{3\frac{1}{2}-4\frac{1}{2}}{14-15}$ ..... 59. *oligacanthus* Blkr.

b. Middle soft dorsal rays produced, at least as long as head.

[Sauv.

Sq. 32–34 $\frac{4-5}{14-15}$ ..... 60. *madagascariensis*

Sq. 35 $\frac{6}{16}$ ..... 61. *grandidieri* Sauv.

2. Head 3⅓ times in total length; D. XIV–XV 12–13; A. III 10; middle soft dorsal and anal rays produced; Sq. 31–33 $\frac{4}{15}$ ..... 62. *betsileana* Blgr.

1. TILAPIA HUNTERI.

Oreochromis hunteri, Günth. Proc. Zool. Soc. 1889, p. 70.

Teeth very small, in 7 or 8 closely-set series in both jaws. Depth of body equal to length of head, 3⅓ times in total length. Snout with concave upper profile, nearly twice diameter of eye, which is 5 times in length of head and twice in interorbital width; mouth rather large, nearly ¾ width of head; maxillary extending to between nostril and eye; 3 series of scales on the cheek. Dorsal XVII 11; last spine longest, ⅓ length of head, ½ longest soft rays. Pectoral pointed, a little shorter than the head, not extending to origin of anal. Ventral reaching vent. Anal IV 10; fourth spine longest, a little shorter than last dorsal. Caudal truncate. Caudal peduncle a little longer than deep. Scales cycloid, 35 $\frac{5}{15}$; lat. l. $\frac{19}{16}$. Dark brown, tinged with rusty; vertical fins and ventrals blackish.

Total length 300 millim.

Crater Lake, Kilimandjaro.

2. TILAPIA NIGRA.

Oreochromis niger, Günth. Proc. Zool. Soc. 1894, p. 89, pl. ix.

Teeth very small, in 4 or 5 closely-set series in both jaws. Depth of body 2¼ to 2⅔ in total length, length of head 3 to 3⅓ times. Snout with straight upper profile, nearly twice diameter of eye, which is 5 to 5½ times in length of head and 2 to 2¼ in interorbital width; mouth rather large, ⅔ to ¾ width of head; maxillary extending nearly to below anterior border of eye; 2 or 3 series of scales on the cheek. Gill-rakers short, 17 on lower part of anterior arch. Dorsal XVII 11–12; last spine longest, not quite ½ length of head; middle soft rays much produced, more than twice as long as longest dorsal spine. Pectoral pointed, as long as the head, not extending to origin of anal. Ventral reaching anal. Anal IV 9; fourth spine longest, nearly as long as last dorsal; soft rays produced. Caudal truncate or slightly

emarginate. Caudal peduncle slightly deeper than long. Scales cycloid, 32 $\frac{3-4}{13}$; lat. l. $\frac{19-20}{15-17}$. Greenish black; a black opercular spot; fins blackish, soft dorsal and caudal with more or less distinct round light spots between the rays.

Total length 250 millim.

Pools on the Kibwesi River, British East Africa.

3. TILAPIA SHIRANA.

Oreochromis shiranus Bouleng. Proc. Zool. Soc. 1896, p. 916, fig.

Tilapia shirana Bouleng. Tr. Zool. Soc. xv. 1898, p. 4.

Teeth very small, in 5 to 7 very closely-set series in both jaws. Depth of body $2\frac{1}{3}$ to $2\frac{3}{5}$ in total length, length of head 3 times. Snout with straight upper profile, $1\frac{1}{2}$ to $1\frac{2}{3}$ diameter of eye, which is 4 to $4\frac{1}{2}$ times in length of head and $1\frac{2}{3}$ to 2 in interorbital width; mouth moderate, $\frac{3}{5}$ to $\frac{2}{3}$ width of head; maxillary extending to between nostril and eye; 2 series of scales on the cheek. Gill-rakers short, 15 to 18 on lower part of anterior arch. Dorsal XVI–XVII 10–12; last spine longest, $\frac{1}{2}$ length of head or a little less. Ventral reaching vent. Anal IV 9–10; fourth spine longest, as long as and stronger than middle dorsals. Caudal peduncle not longer than deep. Scales cycloid, 31–32 $\frac{3}{13}$; lat. l. $\frac{20-21}{15-16}$.

Total length 210 millim.

Upper Shiré River, Nyassaland.

4. TILAPIA MOSSAMBICA.

Chromis (*Tilapia*) *mossambicus*, Peters, Mon. Berl. Ac. 1852, p. 681.

Chromis niloticus, part., Peters, Arch. f. Nat. 1855, p. 267; Günther, Cat. iv. p. 510 (1862); Peters, Reise n. Mossamb. iv. p. 23, pl. iv. fig. 4 (1868).

Chromis mossambicus, part., Günth, l. c. p. 268.

Tilapia mossambica, Bouleng. Tr. Zool. Soc. xv. 1888, p. 4.

Teeth very small, in 4 to 7 series in both jaws. Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ times in total length, length of head $2\frac{2}{3}$ to 3 times. Snout with concave upper profile, 2 to $2\frac{1}{2}$ times diameter of eye, which is 5 to 6 times in length of head and 2 to $2\frac{1}{2}$ times in interorbital width; mouth large, nearly as broad as the head; maxillary extending to below anterior border of eye or not quite so far; 2 or 3 series of scales on the cheek, forming a nearly straight or slightly oblique horizontal band, which, under the eye, is at least nearly as broad as the diameter of the eye; large scales on the opercle. Gill-rakers short, 17 to 20 on lower part of anterior arch. Dorsal XV–XVI 10–11; last spine longest, $\frac{1}{3}$ to $\frac{2}{5}$ length of head, $\frac{1}{2}$ to $\frac{2}{3}$ longest soft rays. Pectoral pointed, as long as or a little shorter than the head, extending at least as far as origin of anal. Ventral reaching vent or origin of anal. Anal

III (rarely IV) 9–10; third spine a little shorter but stronger than last dorsal spine. Caudal rounded. Caudal peduncle as long as deep. Scales cycloid, 30–33 $\frac{3\frac{1}{2}-4\frac{1}{2}}{13-15}$; lat. l. $\frac{19-21}{10-15}$. Brownish or olive, vertical fins and ventrals darker.

Total length 270 millim.

East Africa, from the Coast of Zanzibar to the Zambesi.

5. TILAPIA NILOTICA.

Labrus niloticus, Linn. in Hasselq. Iter Palæst. p. 346 (1757), and S. N. i. p. 477 (1766); Sonnini, Voy. Égypte, ii. p. 395, pl. xxvii. fig. 1 (1799).

Chromis nilotica, Cuv., Guérin, Icon. R. An. i. Poiss. pl. xliv. fig. 1 (1844); Sauv. Bull. Soc. Philom. (7) iv. 1880, p. 211; Lortet, Ann. Mus. Lyon, iii. 1883, p. 137, pl. vii.; Mitchell, Rep. Fish. L. Menzaleh, p. 12, pl. ii. (1895); Günth. Proc. Zool. Soc. 1896, p. 218.

Chromis niloticus, part., Günth. Cat. iv. p. 267 (1862), and Proc. Zool. Soc. 1864, p. 490; Steind. Verh. zool.-bot. Ges. Wien, xiv. 1864, p. 226; Peters, Reise Mossamb. iv. p. 23 (1868); Günth. in Petherick, Trav. C. Afr. ii. p. 216 (1869); Steind. Sitzb. Ak. Wien, lx. 1870, p. 96; Pfeffer, Jahrb. Hamb. wiss. Anst. x. 1893, p. 149; Vinciguerra, Ann. Mus. Genova, (2) xv. 1895, p. 28; Pfeffer, Thierw. O.-Afr., Fische, p. 10 (1896).

Chromis guentheri, Steind. Verh. zool.-bot. Ges. Wien, xiv. 1864, p. 228, pl. viii. figs. 3 & 4.

Chromis spilurus, Günth. Proc. Zool. Soc. 1894, p. 89, pl. x. fig. A, and 1896, p. 219.

Tilapia nilotica, Bouleng. Tr. Zool. Soc. xv. 1898, p. 6.

Teeth very small, in 4 to 6 series in both jaws. Depth of body $2\frac{1}{8}$ to $2\frac{1}{2}$ times in total length, length of head $2\frac{2}{3}$ to $3\frac{1}{4}$ times. Snout with nearly straight upper profile, $1\frac{1}{3}$ to $1\frac{1}{2}$ diameter of eye (shorter in the young), which is $4\frac{1}{2}$ to 6 times in length of head ($3\frac{1}{2}$ to $3\frac{2}{3}$ in the young), and $1\frac{1}{2}$ to $2\frac{1}{4}$ times in interorbital width; mouth moderate, $\frac{1}{2}$ to $\frac{2}{3}$ width of head, extending to below anterior border of eye or between the nostril and the eye; 2 or 3 series of scales on the cheek, forming, under the eye, a nearly straight horizontal band which equals or exceeds the width of the naked præopercle; large scales on the opercle. Gill-rakers short, 17 to 23 on lower part of anterior arch. Dorsal XV–XVIII 11–13; last spine longest, $\frac{2}{5}$ to $\frac{1}{2}$ length of head, $\frac{3}{5}$ to $\frac{2}{3}$ length of longest soft rays. Pectoral falciform, 1 to $1\frac{1}{4}$ length of head, extending as far as origin of anal or a little beyond. Ventral reaching vent or anal. Anal III 9–11; third spine as long as or a little shorter than longest dorsal spine. Caudal rounded. Caudal peduncle slightly deeper than long. Scales cycloid, 31–35 $\frac{4-5}{14-15}$; lat. l. $\frac{19-25}{13-15}$. Olive, some or most of the scales darker at the base, or lighter and golden in the centre; vertical fins with blackish and whitish spots forming transverse or oblique streaks; a blackish opercular spot; young with 8 or 9 more or less distinct dark bars

on the body and a dark spot just below the upper profile of the caudal peduncle.

Total length 350 millim.

Lake of Galilee and Jordan; Nile; Lakes Abaya, Rudolf, Albert Edward, and Victoria; Gallaland; Senegal; Niger.

6. TILAPIA TANGANICÆ.

Chromis tanganicæ, Günth. Proc. Zool. Soc. 1893, p. 630, fig.
Tilapia tanganicæ, Bouleng. Tr. Zool. Soc. xv. 1898, p. 5.

Teeth very small, in 5 or 6 series in both jaws. Depth of body $2\frac{1}{3}$ in total length, length of head $2\frac{1}{5}$. Snout with straight upper profile, slightly longer than diameter of eye, which is $3\frac{1}{2}$ times in length of head and $1\frac{2}{5}$ in interorbital width; mouth rather small, $\frac{3}{5}$ width of head, extending to below nostril; 3 series of scales on the cheek; large scales on the opercle. Gill-rakers short, slender, 20 or 21 on lower part of anterior arch. Dorsal XVI–XVII 11–13; spines equal in length from the sixth, measuring $\frac{2}{5}$ length of head and $\frac{3}{4}$ longest soft rays. Pectoral pointed, a little longer than head, extending beyond origin of anal. Ventral reaching vent. Anal III 9–10; third spine a little shorter than longest dorsals. Caudal truncate, slightly emarginate. Caudal peduncle as long as deep. Scales cycloid, 32–33 $\frac{4}{19-20}$; lat. l. $\frac{14-18}{8-12}$. Olive above, silvery beneath; soft dorsal with rather indistinct oblique dark streaks.

Total length 95 millim.

Lake Tanganyika.

7. TILAPIA NATALENSIS.

Chromis niloticus, part., Peters, Arch. f. Nat. 1855, p. 267, and Reise n. Mossamb. iv. p. 23 (1868); Pfeffer, Jahrb. Hamb. wiss. Anst. x. 1893, p. 149, pl. iii. figs. 1–4, and Thierw. O.-Afr., Fische, p. 10, fig. (1896).
Chromis mossambicus, part., Günth. Cat. iv. p. 268 (1862).
Chromis natalensis, M. Weber, Zool. Jahrb., Syst. x. 1897, p. 147.

Teeth very small, in 4 or 5 series in both jaws. Depth of body $2\frac{1}{4}$ to $2\frac{2}{3}$ times in total length, length of head 3 times. Snout with straight or slightly convex upper profile, $1\frac{1}{2}$ to $1\frac{3}{4}$ diameter of eye, which is 4 to $4\frac{2}{3}$ times in length of head and $1\frac{1}{2}$ to 2 in interorbital width; mouth moderate, $\frac{3}{5}$ to $\frac{2}{3}$ width of head; maxillary extending to between nostril and eye; 2 or 3 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 17 to 20 on lower part of anterior arch. Dorsal XVI–XVIII 10–12; last spine longest, $\frac{2}{5}$ to $\frac{1}{2}$ length of head, $\frac{1}{2}$ to $\frac{2}{3}$ longest soft rays. Pectoral pointed, as long as or a little longer ($1\frac{1}{5}$) than the head, extending to origin of anal. Ventral reaching vent or origin of anal. Anal III 9–11; third spine a little shorter but stronger than last dorsal spine. Caudal truncate or very slightly notched. Caudal peduncle as long as deep or a little longer than deep. Scales

cycloid, 31–34 $\frac{3\frac{1}{2}-4\frac{1}{2}}{14}$; lat. l. $\frac{19-21}{12-17}$. Brownish or olive, uniform or with darker spots at the bases of the scales: young with more or less distinct dark bars on the body, oblique streaks on the soft dorsal and anal, and two or three bars across the caudal; opercular spot usually very indistinct.

Total length 180 millim.

East and South-east Africa, from the coast of Zanzibar to Natal.

8. Tilapia galilæa.

Sparus galilæus, Artedi, in Hasselq. Reise Palæst. p. 389 (1762).

Chromis ? galilæus, Günth. Cat. iv. p. 273 (1859).

Chromis niloticus part., Günth. l. c. p. 267, and Proc. Zool. Soc. 1864, p. 490, and in Petherick, Trav. C. Afr. ii. p. 216 (1869); Steind. Sitz. Ak. Wien, lx. 1870, p. 964, pl. iv. fig. 1.

Chromis niloticus, Steind. Verh. zool.-bot. Ges. Wien, xiv. 1864, p. 226; Tristram, Faun. Palest. pl. xviii. fig. 1 (1884).

Chromis tiberiadis, Lortet, Ann. Mus. Lyon, iii. 1883, p. 135, pl. vi.

Chromis microstomus, Lortet, l. c. p. 139, pl. viii. fig. 1.

Teeth very small, in 4 to 6 series in both jaws. Depth of body 2 to $2\frac{1}{3}$ times in total length, length of head $2\frac{2}{3}$ to 3 times. Snout with straight or convex upper profile, $1\frac{1}{4}$ to $1\frac{2}{3}$ diameter of eye, which is 4 to 5 times in length of head and $1\frac{1}{2}$ to 2 in interorbital width; mouth narrow, not more than $\frac{1}{2}$ width of head, extending to below the nostril; 2 or 3 series of scales on the cheek, forming a narrow oblique band which in its widest part does not exceed the width of the naked præopercle; large scales on the opercle. Gill-rakers short, 20 to 25 on lower part of anterior arch. Dorsal XVI–XVII,12–14; last spine longest, $\frac{1}{2}$ to $\frac{2}{3}$ length of head, $\frac{3}{5}$ to $\frac{2}{3}$ longest soft rays. Pectoral falciform, $1\frac{1}{4}$ to $1\frac{2}{3}$ length of head, extending to origin of anal or beyond. Ventral reaching vent or origin of anal. Anal III 10–11; third spine as long as or a little shorter and stronger than last dorsal spine. Caudal truncate or slightly notched. Caudal peduncle deeper than long. Scales cycloid, 31–34 $\frac{3\frac{1}{2}}{14-15}$; lat. l. $\frac{19-22}{12-14}$. Brownish or olive, without spots or bars; a more or less distinct dark opercular spot; vertical fins greyish or brown, without markings.

Total length 300 millim.

Lake of Galilee and Jordan, Nile, Senegal, Niger.

9. Tilapia microcephala.

Chromis microcephalus (Bleek.), Günth. Cat. iv. p. 272 (1862).

Melanogenes microcephalus, Bleek. Nat. Verh. Vet. Haarlem, xviii. 1863, no. 2, p. 37, pl. vi. fig. 1.

Teeth very small, closely set, in 4 or 5 series in both jaws. Depth of body 2 to $2\frac{1}{3}$ times in total length, length of head $2\frac{1}{3}$ to 3 times. Snout with straight or convex upper profile, $1\frac{1}{4}$ to $1\frac{1}{2}$ diameter of eye, which is $3\frac{2}{3}$ to 4 times in length of head and $1\frac{1}{3}$

to $1\frac{1}{3}$ in interorbital width; mouth narrow, $\frac{1}{2}$ to $\frac{3}{5}$ width of head, extending to between nostril and eye; 2 series of scales on the cheek, forming a narrow oblique band; large scales on the opercle. Gill-rakers short, 15 to 19 on lower part of anterior arch. Dorsal XV–XVI 11–13; last spine longest, $\frac{1}{2}$ or a little less than $\frac{1}{2}$ length of head, $\frac{3}{5}$ to $\frac{2}{3}$ longest soft rays. Pectoral falciform, $1\frac{1}{4}$ to $1\frac{1}{3}$ length of head, extending to origin of anal or beyond. Ventral reaching vent or anal. Anal III 9–11; third spine shorter than last dorsal. Caudal truncate, slightly emarginate. Caudal peduncle deeper than long. Scales cycloid, 28–30 $\frac{2\frac{1}{2}-3}{11-12}$; lat. l. $\frac{17-21}{11-13}$. Olive above, golden beneath, uniform or with 5 or 6 very indistinct, narrow, dark bars; soft dorsal with dark and light spots forming oblique streaks; a dark opercular spot.

Total length 175 millim.

Gold Coast.

10. Tilapia macrocephala.

Sarotherodon melanotheron (nom. nud.), Rüpp. Verz. Mus. Senck. iv. p. 21 (1852); Günth. Cat. iv. p. 273 (1862).

Chromis macrocephalus (Bleek.), Günth. l. c.

Melanogenes macrocephalus, Bleek. Nat. Verh. Vet. Haarlem, xviii. 1863, no. 2, p. 36, pl. vi. fig. 2.

Teeth very small, closely set, in 4 to 6 series in both jaws. Depth of body $2\frac{1}{3}$ to $2\frac{2}{5}$ times in total length, length of head $2\frac{2}{5}$ to $2\frac{2}{3}$ times. Snout with straight or convex upper profile, $1\frac{1}{3}$ to $1\frac{1}{2}$ diameter of eye, which is 4 to $4\frac{1}{2}$ times in length of head and $1\frac{1}{2}$ to $1\frac{2}{3}$ in interorbital width; mouth moderate, about $\frac{2}{3}$ width of head, extending to between nostril and eye; 2 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 15 to 17 on lower part of anterior arch. Dorsal XV–XVI 10–12; last spine longest, $\frac{2}{5}$ length of head, $\frac{1}{2}$ longest soft rays, which are somewhat produced. Pectoral falciform, $1\frac{1}{5}$ to $1\frac{1}{4}$ length of head, extending to origin of anal or beyond. Ventral reaching origin of anal. Anal III 7–9; third spine a little shorter than last dorsal. Caudal truncate, slightly emarginate. Caudal peduncle deeper than long. Scales cycloid, 28–30 $\frac{2\frac{1}{2}-3}{11-12}$; lat. l. $\frac{19}{10-13}$. Olive-brown above, golden beneath; indistinct light spots on the soft dorsal and caudal fins, forming oblique streaks on the former; a black opercular spot; chin and gular region black, or marbled with black.

Total length 145 millim.

Gold Coast.

11. Tilapia nigripinnis.

Tilapia nigripinnis (Guichen.), A. Dum. Arch. Mus. x. 1859, p. 254, pl. xxii. fig. 2.

Chromis nigripinnis, Günth. Cat. iv. p. 270 (1862).

Teeth very small, in 4 or 5 closely-set series in both jaws.

Depth of body $2\frac{1}{4}$ in total length, length of head 3 times. Snout with slightly concave upper profile, $1\frac{1}{4}$ diameter of eye, which is $3\frac{1}{2}$ in length of head and $1\frac{1}{3}$ in interorbital width; mouth small, $\frac{3}{5}$ width of head, maxillary extending little beyond vertical of nostril; 2 series of scales on the cheek, forming a narrow oblique band; large scales on the opercle. Gill-rakers short, 16 on lower part of anterior arch. Dorsal XVI 10; spines nearly equal in length from the 6th, which measures $\frac{2}{5}$ length of head and $\frac{2}{3}$ longest soft rays. Pectoral pointed, a little longer than the head, extending to origin of anal. Ventral reaching vent. Anal III 8–9. Caudal truncate, slightly emarginate. Caudal peduncle a little deeper than long. Scales cycloid, 29 $\frac{2\frac{1}{2}-3}{12}$; lat. l. $\frac{18}{10}$. Brown; indistinct darker oblique streaks on the soft dorsal.

Total length 115 millim.

Gaboon.

12. Tilapia dumerili.

Chromis dumerilii, Steind. Verh. zool.-bot. Ges. Wien, xiv. 1864, p. 225, pl. vii. fig. 1.

Teeth small, in 4 series in both jaws. Depth of body equal to length of head, $2\frac{1}{2}$ to $2\frac{2}{5}$ in total length. Snout with straight upper profile, nearly $1\frac{1}{2}$ diameter of eye, which is about $4\frac{1}{2}$ in length of head; mouth rather large; maxillary extending to below anterior border of eye; 2 series of scales on the cheek. Dorsal XV 10; last spine longest, nearly $\frac{2}{5}$ length of head, $\frac{3}{5}$ longest soft rays. Pectoral pointed, a little longer than the head, extending beyond origin of anal. Ventral reaching origin of anal. Anal III 9. Caudal truncate, scaly in the basal half. Caudal peduncle a little deeper than long. Scales cycloid, 30–31 $\frac{3-3\frac{1}{2}}{10}$; lat. l. $\frac{18}{14}$. Brown, each scale darker at the base; a very narrow blackish opercular spot.

Total length 133 millim.

West Africa.

Apparently nearly allied to *T. macrocephala*, but distinguished by a larger mouth.

13. Tilapia lepidura, sp. n.

Teeth very minute, in 4 closely-set series in both jaws. Depth of body $2\frac{2}{7}$ to $2\frac{1}{2}$ times in total length, length of head $2\frac{3}{4}$ to 3. Snout with convex upper profile, $1\frac{1}{3}$ to $1\frac{1}{2}$ diameter of eye, which is $3\frac{2}{3}$ to 4 times in length of head and $1\frac{1}{2}$ to 2 in interorbital width; mouth moderate, $\frac{3}{5}$ width of head, extending to between nostril and eye; 2 or 3 series of scales on the cheek; large scales on the opercle. Gill-rakers short, slender, 17 to 20 on lower part of anterior arch. Dorsal XVI 10; last spine longest, $\frac{2}{5}$ length of head. Pectoral pointed, as long as head, extending as far as origin of anal. Ventral reaching vent. Anal III 8–9; third spine a little shorter than last dorsal. Caudal rounded, densely scaled. Caudal peduncle

deeper than long. Scales cycloid, 29–30 $\frac{3\text{-}3\frac{1}{2}}{13}$; lat. l. $\frac{17\text{-}20}{11\text{-}13}$. Brownish above, golden beneath; a blackish opercular spot; dorsal and anal with blackish spots forming oblique streaks on the soft part of the dorsal; caudal with a wide-meshed dark network.

Total length 160 millim.

Lower Congo and Angola.

14. TILAPIA SQUAMIPINNIS.

Chromis squamipinnis, Günth. Proc. Zool. Soc. 1864, p. 311, and 1893, p. 621, pl. liii.

Tilapia squamipinnis, Bouleng. Tr. Zool. Soc. xv. 1898, p. 4.

Teeth small, in 4 or 5 closely-set series in both jaws. Depth of body $2\frac{1}{2}$ to $2\frac{2}{3}$ in total length, length of head $2\frac{3}{4}$ to 3 times. Snout with straight or slightly convex upper profile, $1\frac{1}{3}$ to $1\frac{1}{2}$ diameter of eye (as long as eye in the young), which is 4 times in length of head (3 to $3\frac{1}{2}$ times in the young), and twice in interorbital width ($1\frac{1}{3}$ to $1\frac{1}{2}$ in the young); mouth narrow, $\frac{1}{2}$ to $\frac{3}{5}$ width of head; maxillary extending to between nostril and eye; 2 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 17 to 19 on lower part of anterior arch. Dorsal XVI 10–11; spines subequal from the middle ones, $\frac{1}{3}$ to $\frac{1}{2}$ length of head, about $\frac{3}{4}$ longest soft rays. Pectoral pointed, as long as or a little longer than the head, reaching origin of anal or a little beyond. Ventral reaching vent. Anal III 8–9; third spine nearly as long as longest dorsals. Caudal slightly notched, upper angle pointed, lower rounded and shorter. Caudal peduncle a little longer than deep. Scales cycloid, 32–35 $\frac{3\frac{1}{2}}{15\text{-}16}$; lat. l. $\frac{21\text{-}22}{13\text{-}17}$. Pale greyish olive, with 8 more or less regular blackish cross-bars; oblique dark streaks on the soft dorsal and a large dark spot between the anterior rays.

Total length 250 millim.

Lake Nyassa and Upper Shiré River.

15. TILAPIA MACROCENTRA.

Tilapia macrocentra, A. Dum. Arch. Mus. x. 1859, p. 256.

Chromis macrocentra, Rochebr. Actes Soc. Linn. Bord. (4) vi. 1883, p. 133.

Depth of body $2\frac{1}{6}$ in total length. 3 series of scales on the cheek. 22 gill-rakers on lower part of anterior arch. Dorsal XIV 13, the spines remarkably strong and triangular. Anal III 10. Caudal rounded. Scales very large, cycloid, 26 in the lateral series. Uniform brown.

Total length 260 millim.

Senegal.

I am indebted to the kindness of Prof. Vaillant for some notes on the gill-rakers, scales, and shape of the caudal in this and the other species so imperfectly described by Aug. Duméril.

16. TILAPIA PLEUROMELAS.

Tilapia pleuromelas, A. Dum. Arch. Mus. x. 1859, p. 253.
Tilapia lateralis, A. Dum. l. c.
Chromis pleuromelas, Günth. Cat. iv. p. 271 (1862).
Chromis lateralis, Günth. t. c. p. 272.

Depth of body about twice in total length. 2 series of scales on the cheek. 15–17 gill-rakers on lower part of anterior arch. Dorsal XIV 12–14. Anal III 10. Caudal rounded. Scales cycloid, 26–29 $\frac{3\frac{1}{2}-4}{\times}$. Brown; a large black blotch on each side of the body.

Total length 200 millim.

Senegal.

17. TILAPIA HEUDELOTI.

Tilapia heudelotii, A. Dum. Arch. Mus. x. 1859, p. 254.
Chromis heudelotii, Günth. Cat. iv. p. 270 (1862).

Depth of body a little more than twice in total length. 3 series of scales on the cheek. 16 gill-rakers on lower part of anterior arch. Dorsal XIV 10. Anal III 7. Caudal rounded (?). Scales cycloid, 27 $\frac{3\frac{1}{2}}{\times}$. Brownish; soft dorsal with irregular light and dark streaks.

Total length 120 millim.

Senegal.

18. TILAPIA SPARRMANI.

Tilapia sparrmanii, Smith, Ill. Zool. S. Afr., Fish. pl. v. (1840).
Chromis sparmanni, Günth. Cat. iv. p. 269 (1862).
Chromis niloticus, part., Peters, Reise n. Mossamb. iv. p. 23 (1868).

Teeth very small, in 3 to 5 series in both jaws. Depth of body $2\frac{1}{4}$ to $2\frac{2}{3}$ times in total length, length of head 3 to $3\frac{1}{4}$. Snout with straight or slightly convex upper profile, as long as the eye, which is $3\frac{1}{2}$ to 4 times in length of head and $1\frac{1}{4}$ to $1\frac{2}{3}$ in interorbital width; mouth moderate, $\frac{3}{5}$ width of head; maxillary extending to below anterior border of eye; 2 series of scales on the cheek; large scales on the opercle. Gill-rakers very short, 10 to 12 on lower part of anterior arch. Dorsal XIII–XV 9–11; last spine longest, $\frac{2}{5}$ to $\frac{1}{2}$ length of head, $\frac{1}{2}$ to $\frac{2}{3}$ longest soft rays. Pectoral pointed, a little shorter than the head, not extending to origin of anal. Ventral reaching origin of anal. Anal III 9; third spine a little shorter but stronger than last dorsal spine. Caudal rounded. Caudal peduncle as long as deep. Scales cycloid, 27–29 $\frac{2\frac{1}{2}-3}{9-10}$; lat. l. $\frac{17-19}{8-12}$. Pinkish to brownish, with 7 or 8 rather indistinct dark brown or olive bars; vertical fins with some small dark spots; a large blackish spot on the dorsal, between the anterior soft rays; a dark opercular spot.

Total length 145 millim.

South-west Africa, from Angola and the Victoria Falls to Namaqualand.

19. TILAPIA OVALIS.

Chromis ovalis, Steind. Verh. zool.-bot. Ges. Wien, xvi. 1866, p. 761.

Allied to *T. zillii*. Depth of body equal to length of head, 3 times in total length. Snout with straight upper profile; diameter of eye 4 times in length of head, a little less than interorbital width; maxillary extending a little beyond vertical of anterior border of eye; 3 series of scales on the cheek. Dorsal XIV 11; last spine longest; middle soft rays produced. Pectoral shorter than the head. Ventral extending a little beyond origin of anal. Anal III 8. Caudal rounded. Scales $29\frac{3}{10}$; lat. l. $\frac{19}{12}$. Olive-brown, with indistinct darker bars; a black opercular spot; dorsal and anal with black streaks; a black spot on the anterior soft rays of the dorsal.

Total length 100 millim.

Angola.

20. TILAPIA MENZALENSIS.

Chromis menzalensis, Mitchell, Rep. Fish. L. Menzaleh, p. 13, pl. iii. (1895).

Teeth in 4 or 5 series in both jaws, outer rather large. Depth of body $2\frac{2}{5}$ in total length, length of head 3 times. Snout with straight or slightly concave upper profile, $1\frac{1}{3}$ to 2 diameter of eye, which is 4 to 5 times in length of head and $1\frac{1}{3}$ to 2 in interorbital width; mouth large, $\frac{3}{4}$ to $\frac{4}{5}$ width of head; maxillary extending to below anterior border of eye; 3 or 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 9 or 10 on lower part of anterior arch. Dorsal XV 12–13; last spine longest, $\frac{2}{5}$ to $\frac{1}{2}$ length of head; middle soft rays produced in adult specimens, about twice as long as last spine. Pectoral pointed, as long as the head or a little shorter, not extending to origin of anal. Ventral produced in the adult, reaching anal. Anal III 8–9; third spine shorter than longest dorsal, soft rays produced like the dorsals. Caudal truncate, rounded in old specimens. Caudal peduncle as long as deep. Scales cycloid, 30–$31\frac{3}{12}$; lat. l. $\frac{20-21}{11-14}$. Olive, with 7 or 8 dark bars, sometimes with a dark stripe along the middle of the side; ventrals and vertical fins dark, the latter sometimes with ill-defined lighter spots; a more or less distinct round black spot between the anterior soft rays of the dorsal; a black opercular spot.

Total length 235 millim.

Lake Menzaleh, Lower Egypt.

21. TILAPIA ZILLII.

Acerina zillii, Gervais, Ann. Sc. Nat. (3) x. 1848, p. 203.

Coptodon zillii, Gervais, Bull. Soc. Agric. Hérault, 1853, p. 80, pl. iv. figs. 5–7; A. Dum. Arch. Mus. x. 1859, p. 252.

Glyphisodon zillii, Valenc. C.R. Ac. Sc. xlvi. 1858, p. 713.

Haligenes tristrami, Günth. Proc. Zool. Soc. 1859, p. 471, pl. ix. fig. B.

Chromis tristrami, part., Günth. Cat. iv. p. 269 (1862).

Sarotherodon (?) *zillii*, Günth. Cat. iv. p. 274.

Chromis andreæ, Günth. Proc. Zool. Soc. 1864, p. 492; Lortet, Ann. Mus. Lyon, iii. 1883, p. 142, pl. viii. fig. 3; Tristram, Faun. Palest. pl. xvii. fig. 1 (1884).

Chromis niloticus, part., Gervais, Zool. Pal. Gén. p. 205, pl. xlv. fig. 3 (1869), and Journ. Zool. iii. 1874, p. 455.

Chromis mossambicus, part., Steind. Sitzb. Ak. Wien, lx. i. 1870, p. 23.

Chromis zillii, Sauvage, Bull. Soc. Philom. (7) i. 1877, p. 163; Rolland, Rev. Scientif. (4) ii. 1894, p. 418. fig.

Chromis tristrami, Günth. Proc. Zool. Soc. 1896, p. 218.

Tilapia tristrami, Bouleng. Tr. Zool. Soc. xv. 1898, p. 6.

Teeth in 3 or 4 series in both jaws, outer rather large. Depth of body $2\frac{1}{2}$ to $2\frac{3}{5}$ in total length, length of head $2\frac{3}{4}$ to $3\frac{1}{4}$ times. Snout with straight upper profile, $1\frac{1}{4}$ to $1\frac{2}{3}$ diameter of eye, which is $3\frac{1}{2}$ to $4\frac{1}{2}$ in length of head and 1 to $1\frac{1}{2}$ in interorbital width; mouth moderate, $\frac{2}{5}$ to $\frac{2}{3}$ width of head; maxillary extending to below anterior border of eye; 3 or 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 8 to 10 on lower part of anterior arch. Dorsal XIV–XV 10–13; last spine longest, $\frac{2}{5}$ to $\frac{1}{2}$ length of head; middle soft rays produced in adult specimens, about twice as long as last spine. Pectoral pointed, as long as the head or a little shorter, not extending to origin of anal. Ventral produced in the adult, reaching vent or anal. Anal III 7–9; third spine as long as or a little shorter than longest dorsal, soft rays produced like the dorsals. Caudal truncate. Caudal peduncle as long as deep. Scales mostly cycloid, 30–32 $\frac{3}{11-12}$; lat. l. $\frac{17-21}{12-15}$. Olive, with 6 to 8 more or less distinct darker bars, sometimes with a dark stripe along the middle of the side; vertical fins usually with more or less distinct lighter round spots; a large round blackish spot usually present between the anterior soft rays of the dorsal; a dark opercular spot.

Total length 210 millim.

Algerian Sahara to Lake Rudolf and the Lake of Galilee [1].

Chromis faidherbi, Rochebr. Bull. Soc. Philom. (7) iv. 1880, p. 167, and Act. Soc. Linn. Bord. (4) vi. 1883, p. 134, pl. v. fig. 5, from the Senegal, appears to be allied to *C. zillii*, but the description is insufficient and contradicted by the accompanying figure.

D. XIV 11; A. III 7; Sq. $27\frac{3}{4}$. 3 dark bars on the body.

22. TILAPIA MAGDALENÆ.

Chromis magdalenæ, Lortet, Arch. Mus. Lyon, iii. 1883, p. 146, pl. ix. fig. 2.

[1] I have not seen Egyptian specimens; but, according to Panceri (Rend. Acc. Sc., Soc. R. Nap. xii. 1873, p. 113), the species has been found in the artesian wells of the oases of the Libyan Desert by Figari Bey (Stud. sc. sull' Egitto, 1864, i. p. 287).

Teeth very small, in 3 or 4 rows in both jaws. Depth of body $2\frac{2}{3}$ to $2\frac{3}{4}$ in total length, length of head $2\frac{2}{3}$ to 3 times. Snout with straight or humped upper profile, $1\frac{1}{2}$ to 2 as long as the diameter of the eye, which is $4\frac{1}{2}$ to 6 times in length of head and $1\frac{1}{3}$ to $1\frac{3}{4}$ in interorbital width; mouth moderate, $\frac{3}{5}$ to $\frac{3}{8}$ width of head; maxillary extending to between nostril and eye; 3 or 4 series of scales on the cheek. Gill-rakers short, 10 on lower part of anterior arch. Dorsal XIV–XV 9–10; last spine longest, $\frac{1}{3}$ to $\frac{2}{5}$ length of head, $\frac{3}{5}$ to $\frac{3}{4}$ longest soft rays. Pectoral pointed, a little shorter than the head, not extending to origin of anal. Ventral not reaching vent. Anal III 7–8; third spine as long as or a little shorter than last dorsal. Caudal rounded. Caudal peduncle as long as deep or slightly longer than deep. Scales cycloid, 30–32 $\frac{3-3\frac{1}{2}}{15-17}$; lat. l. $\frac{18-21}{11-12}$. Brownish green above, bluish silvery below; 8 oblique dark bars on the body, sometimes very indistinct; fins uniform bluish white; a dark bar below the eye; a black opercular spot.

Total length 160 millim.

Syria.

23. TILAPIA THOLLONI.

Chromis tholloni, Sauvage, Bull. Soc. Zool. France, 1884, p. 196, pl. v. fig. 1.

Teeth very small. Depth of body $2\frac{2}{3}$ in total length, length of head 3 times. Snout with slightly concave upper profile, $1\frac{1}{2}$ diameter of eye, which is 4 times in length of head; interorbital space a little wider than diameter of eye; maxillary not quite reaching to below anterior border of eye; 4 series of scales on the cheek. Dorsal XVI 8; last spine longest, about $\frac{1}{2}$ length of longest soft rays. Pectoral obtuse, nearly as long as the head, not extending to origin of anal. Ventral extending beyond origin of anal. Anal III 9. Caudal rounded. Caudal peduncle nearly as long as deep. Scales cycloid, 32 $\frac{3}{10}$. Olive; a black opercular spot and a blackish lateral stripe; soft dorsal and caudal with purplish spots.

Total length 180 millim.

Upper Ogowe.

24. TILAPIA CABRÆ.

Tilapia cabræ, Bouleng. Ann. Mus. Congo, Zool. i. 1899, p. 51, pl. xxvii.

Teeth in outer row moderate, separated by an interspace from a band of 4 transverse series of smaller closely-set teeth. Depth of body 2 to $2\frac{1}{3}$ in total length, length of head 3 times. Snout with straight upper profile, $1\frac{1}{2}$ to $1\frac{2}{3}$ diameter of eye, which is 4 to $4\frac{1}{2}$ times in length of head and $1\frac{1}{3}$ to 2 in interorbital width; mouth $\frac{3}{4}$ width of head, extending to between nostril and eye; 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 10 to 12 on lower part of anterior arch. Dorsal XVI 12–13; last spine longest, $\frac{2}{5}$ to $\frac{1}{2}$ length of head, $\frac{2}{5}$ to $\frac{2}{7}$

middle soft rays, which are much produced. Pectoral pointed, as long as head, not extending to origin of anal. Ventral reaching vent or origin of anal. Anal III 10-11; third spine shorter than last dorsal; soft rays produced like the dorsals. Caudal rounded. Caudal peduncle deeper than long. Scales cycloid, $32\frac{3-3\frac{1}{2}}{11-13}$; lat. l. $\frac{20-21}{12-14}$. Olive-brown; a black opercular spot; soft dorsal and caudal with numerous small round blackish spots.

Total length 340 millim.

Loango.

25. Tilapia mariæ, sp. n. (Plate XI. fig. 1.)

Teeth small, in 3 series in both jaws. Depth of body 2 to $2\frac{2}{5}$ in total length, length of head $2\frac{3}{4}$ to 3 times. Snout with straight upper profile, as long as diameter of eye, which is 3 times in length of head and $1\frac{1}{4}$ to $1\frac{1}{3}$ in interorbital width; mouth rather small, $\frac{2}{3}$ width of head; maxillary extending to between nostril and eye; 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 13 on lower part of anterior arch. Dorsal XVI 12; spines equal in length from the 5th, $\frac{1}{2}$ length of head. Pectoral pointed, as long as head, not extending to origin of anal. Ventral produced into a filament, reaching origin of anal. Anal III 10; third spine nearly as long as longest dorsals. Caudal truncate. Caudal peduncle a little deeper than long. Scales cycloid, 30–31 $\frac{3\frac{1}{2}}{12}$; lat. l. $\frac{21}{14-15}$. Pale brown, with 7 or 8 dark bars, five of which extend on the dorsal.

Total length 80 millim.

Azuminé Creek, Opobo River, Niger Delta. Two specimens, collected by Miss Mary Kingsley.

26. Tilapia horii.

Chromis horii, Günth. Proc. Zool. Soc. 1893, p. 630, pl. lviii. fig. A.

Tilapia horii, Boulenger, Tr. Zool. Soc. xv. 1898, p. 5.

Teeth very small, in 4 or 5 series in both jaws. Depth of body 3 to $3\frac{1}{3}$ times in total length, length of head $2\frac{3}{4}$ to $2\frac{4}{5}$. Snout with straight upper profile, $1\frac{1}{2}$ to $1\frac{2}{3}$ diameter of eye, which is contained 4 times in length of head and a little exceeds interorbital width; mouth moderate, $\frac{2}{3}$ width of head, extending to between nostril and eye; 3 series of scales on the cheek. Gill-rakers short, 13 on lower part of anterior arch. Dorsal XVI 8–9; spines equal from the 5th or 6th, $\frac{1}{3}$ to $\frac{2}{5}$ length of head, $\frac{3}{5}$ to $\frac{2}{3}$ longest soft rays. Pectoral pointed, $\frac{2}{3}$ length of head, not extending to origin of anal. Ventral reaching vent or origin of anal. Anal III 6–7; third spine slightly shorter than longest dorsals. Caudal rounded, subtruncate. Caudal peduncle a little longer than deep. Scales cycloid, 30–31 $\frac{3-4}{11-12}$; lat. l. $\frac{19-21}{11-14}$. Pale olive above, with 7 or 8 very indistinct darker bars; large irregular brown spots may be

present on the snout and cheeks; a round white spot may be present between the last two anal rays.

Total length 125 millim.

Lake Tanganyika.

27. TILAPIA MELANOPLEURA.

Tilapia melanopleura, A. Dum. Arch. Mus. x. 1859, p. 252, pl. xxii. fig. 1.

Chromis melanopleura, Günth. Cat. iv. p. 272 (1862).

Depth of body 2 in total length, length of head 3 times. Snout with slightly concave upper profile, $1\frac{1}{2}$ diameter of eye, which is 4 times in length of head; maxillary extending to below anterior border of eye; 5 series of scales on the cheek; large scales on the opercle. 10 gill-rakers on lower part of anterior arch. Dorsal XV 12; last spine longest, $\frac{1}{2}$ length of head, not quite $\frac{1}{2}$ longest soft rays. Pectoral pointed, as long as the head, not extending to origin of anal. Anal III 9; third spine nearly as long as last dorsal. Caudal truncate. Caudal peduncle a little deeper than long. Scales cycloid, 25–26 $\frac{4}{x}$. Brown; a large black blotch on each side of the body.

Total length 150 millim.

Senegal.

28. TILAPIA CÆRULEOMACULATA.

Chromis cæruleomaculatus, Rochebr. Bull. Soc. Philom. (7) iv. 1880, p. 166, and Act. Soc. Linn. Bord. (4) vi. 1883, p. 132, pl. iv. fig. 3.

Depth of body $2\frac{1}{3}$ in total length, length of head 3 times. Snout longer than eye, which is $3\frac{1}{4}$ times in length of head; 5 series of scales on the cheek. Dorsal XIV 11; spines subequal from the fifth. Pectoral rather short, not extending so far as origin of anal. Anal III 10. Caudal truncate, slightly emarginate. Scales 29 $\frac{4}{13}$. Dark green above, pink beneath; a series of 5 large, round, deep blue spots along each side, the first on the opercle.

Total length 137 millim.

Senegal.

29. TILAPIA JALLÆ.

Chromis jallæ, Bouleng. Boll. Mus. Torin. xi. 1896, no. 260.

Teeth small. Depth of body $3\frac{1}{2}$ in total length, length of head $3\frac{1}{4}$ times. Snout a little longer than diameter of eye, which is $3\frac{1}{2}$ times in length of head and equals $1\frac{1}{2}$ interorbital width; maxillary not extending to below anterior border of eye; 6 or 7 series of scales on the cheek; large scales on the opercle. Gill-rakers very short, 9 on lower part of anterior arch. Dorsal XV 10; spines subequal from the 5th, which measures $\frac{1}{3}$ length of head; last soft rays prolonged into filaments. Pectoral $\frac{2}{3}$ length of head. Anal III 8; third spine as long as longest dorsal; soft

rays produced like the dorsals. Caudal truncate. Caudal peduncle $1\frac{1}{2}$ as long as deep. Scales cycloid, $33\frac{3}{8}$; lat. l. $\frac{21}{13}$. Olive-brown, with traces of 5 darker bars.

Total length 75 millim.

Upper Zambesi (district of the Victoria Falls).

30. TILAPIA HUMILIS.

Chromis humilis, Steind. Verh. zool.-bot. Ges. Wien, xvi. 1866, p. 763.

Depth of body $3\frac{3}{5}$ in total length, length of head $3\frac{1}{5}$ times. Snout with straight upper profile; diameter of eye $4\frac{2}{3}$ times in length of head, equal to interorbital width; maxillary not reaching to below anterior border of eye; 6 or 7 series of scales on the cheek. Dorsal XV 10; last spine longest, about $\frac{1}{3}$ length of head; longest soft rays not quite $\frac{1}{2}$ length of head. Pectoral $\frac{3}{5}$ length of head. Anal III 8. Caudal rounded. Scales $30\ \frac{5}{12}$; lat. l. $\frac{21}{14}$. Yellowish brown; a black opercular spot; dorsal and caudal with round blackish spots.

Total length 115 millim.

Angola.

31. TILAPIA GUINEENSIS.

Chromis guineensis (Bleek.), Günth. Cat. iv. pp. 271 & 510 (1862).

Chromis tristrami, part., Günth. t. c. p. 269.

Haligenes guineensis, Bleek. Nat. Verh. Vet. Haarlem, xviii. 1863, no. 2, p. 41, pl. vii.

Teeth small, in 4 series in both jaws. Depth of body $2\frac{1}{3}$ to $2\frac{3}{4}$ in total length, length of head $3\frac{1}{4}$ to $3\frac{1}{3}$ times. Snout deep, with very steep upper profile, measuring about $1\frac{1}{2}$ diameter of eye, which is 4 times in length of head and $1\frac{1}{3}$ in interorbital width; mouth large, $\frac{3}{4}$ width of head; maxillary extending to below anterior border of eye; 4 series of scales on the cheek, forming an oblique band the width of which at least equals the diameter of the eye; large scales on the opercle. Gill-rakers short, 12 on lower part of anterior arch. Dorsal XV–XVI 11–12; last spine longest, $\frac{1}{3}$ to $\frac{2}{3}$ length of head; middle soft rays much produced, nearly 3 times as long as last dorsal spine. Pectoral pointed, a little longer than the head, not extending to origin of anal. Ventral produced, reaching beyond origin of anal. Anal III 9; third spine shorter than longest dorsal, soft rays produced like the dorsals. Caudal feebly emarginate, the outer rays somewhat produced. Caudal peduncle as long as deep. Scales cycloid, $31\ \frac{3}{11}$; lat. l. $\frac{22}{12-14}$. Dark olive; vertical fins with some light spots, confluent into two or three streaks on the dorsal; a black opercular spot.

Total length 190 millim.

Ashantee.

32. Tilapia vorax.

Chromis vorax, Pfeffer, Jahrb. Hamb. wiss. Anst. x. 1893, p. 151, pl. ii. figs. 9–11, and Thierw. O.-Afr., Fische, p. 12, fig. (1896).

Teeth very small, in 3 or 4 series in both jaws. Depth of body nearly equal to length of head, $2\frac{1}{4}$ to $2\frac{3}{4}$ times in total length. Snout with convex upper profile, $1\frac{1}{2}$ to $1\frac{2}{3}$ diameter of eye, which is 5 times in length of head and nearly twice in interorbital width; mouth large; maxillary extending to below anterior border of eye or a little beyond; 3 series of scales on the cheek; large scales on the opercle. Dorsal XV 12–13; middle soft rays much produced, as long as head. Pectoral pointed, nearly as long as head, extending a little beyond origin of anal. Ventral extending beyond origin of anal. Anal III 10; soft rays prolonged like the dorsals. Caudal peduncle as long as deep. Scales cycloid, 28–31 $\frac{4}{12}$; lat. l. $\frac{21}{13}$. Dark-olive brown; a rather indistinct dark opercular spot; vertical fins blackish.

Total length 149 millim.

German East Africa and Mozambique.

33. Tilapia simonis.

Chromis simonis, Günth. Proc. Zool. Soc. 1864, p. 492; Lortet, Arch. Mus. Lyon, iii. 1883, p. 143, pl. ix. fig. 1; Tristram, Faun. Palest. p. 165, pl. xvii. fig. 2 (1884).

Chromis paterfamilias, Lortet, C.R. Ac. Sc. lxxxi. 1875, p. 1197, and La Nature, 1876, p. 81, figs.

Teeth very small, in 4 or 5 series in both jaws. Depth of body equal to length of head, $2\frac{3}{5}$ to $2\frac{2}{3}$ times in total length. Snout with straight upper profile, $1\frac{1}{3}$ to $1\frac{1}{2}$ diameter of eye, which is $4\frac{1}{2}$ to 5 times in length of head and $1\frac{1}{2}$ in interorbital width; mouth moderate, $\frac{2}{3}$ width of head; maxillary extending to between nostril and eye; 3 or 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short and thick, 10 to 12 on lower part of anterior arch. Dorsal XV 9–10; last spine longest, $\frac{1}{3}$ to $\frac{2}{5}$ length of head, $\frac{1}{4}$ to $\frac{2}{3}$ longest soft rays. Pectoral pointed, as long as the head, extending as far as origin of anal. Ventral not reaching vent. Anal III 8–9; third spine a little shorter than last dorsal. Caudal rounded. Caudal peduncle as long as deep. Scales cycloid, 30–32 $\frac{3\frac{1}{2}}{15}$; lat. l. $\frac{18-20}{11-12}$. Olive, with 6 or 7 rather indistinct darker bars; opercular spot feebly marked; a rather indistinct dark spot between the anterior soft rays of the dorsal.

Total length 180 millim.

Syria (Lakes of Galilee and Huleh).

34. Tilapia lata.

Chromis latus, Günth. Cat. iv. p. 271 (1862); Steind. Verh. zool.-bot. Ges. Wien, xiv. 1864, p. 227, pl. viii. figs. 1 & 2.

Chromis niloticus, part., Steind. Sitzb. Ak. Wien, lx. 1870, p. 96.

Chromis microcephalus (non Bleek.), Sauvage, Bull. Soc. Zool. France, 1884, p. 196, fig.

Chromis ogowensis, Günth. Ann. & Mag. N. H. (6) xvii. 1896, p. 271.

Teeth small, in 3 to 5 well separated series in both jaws. Depth of body 2 to $2\frac{1}{2}$ in total length, length of head 3 to $3\frac{1}{4}$ times. Snout with straight or convex upper profile, $1\frac{1}{4}$ to $1\frac{1}{2}$ diameter of eye, which is $3\frac{2}{3}$ to 4 times in length of head and $1\frac{1}{4}$ to $1\frac{1}{2}$ in interorbital width; mouth $\frac{2}{3}$ to $\frac{2}{3}$ width of head; maxillary extending to between nostril and eye; 3 or 4 series of scales on the cheek; large scales on the opercle. Gill-rakers very short, 10 to 12 on lower part of anterior arch. Dorsal XV–XVI 10–14; last spine longest, nearly $\frac{1}{2}$ length of head, $\frac{2}{3}$ to $\frac{1}{2}$ middle soft rays, which are produced in the adult. Pectoral as long as or a little longer than the head, extending as far or nearly as far as origin of anal. Outer ventral ray produced, reaching origin of anal or beyond. Anal III 9–10; third spine shorter than last dorsal. Caudal truncate or slightly emarginate. Caudal peduncle a little deeper than long. Scales cycloid, 29–31 $\frac{2\frac{1}{2}-3\frac{1}{2}}{11-13}$; lat. l. $\frac{19-22}{11-15}$. Olive-brown, with or without 4 or 5 very indistinct darker bars; a black temporal spot; dorsal fin with blackish streaks and a large black spot between the anterior soft rays, the streaks behind the spot very oblique.

Total length 175 millim.

West Africa, from the Gambia to the Loango.

35. TILAPIA RANGII.

Tilapia rangii, A. Dum. Arch. Mus. x. 1859, p. 255.

Chromis rangii, Rochebr. Actes Soc. Linn. Bord. (4) vi. 1883, p. 133.

Depth of body $2\frac{2}{3}$ in total length. 3 series of scales on the cheek. 14 gill-rakers on lower part of anterior arch. Dorsal XV 10. Anal III 8. Pectoral extending beyond origin of anal. Caudal truncate. Scales cycloid, $26\ \frac{3\frac{1}{2}}{\times}$. A black opercular spot; small blackish spots on the soft dorsal.

Total length 100 millim.

Gorea.

36. TILAPIA RENDALLI.

Chromis rendalli, Bouleng. Proc. Zool. Soc. 1896, p. 915, fig.

Tilapia rendalli, Bouleng. Tr. Zool. Soc. xv. 1898, p. 4.

Teeth rather small, forming 4 transverse series well separated from each other. Depth of body $2\frac{1}{4}$ to $2\frac{2}{5}$ in total length, length of head 3 to $3\frac{1}{2}$ times. Snout with steep, slightly convex upper profile, a little longer than the eye, the diameter of which is 4 times in length of head and $1\frac{1}{2}$ in interorbital width; mouth about $\frac{2}{3}$ width of head; maxillary not extending quite to below anterior border of eye; 4 series of scales on the cheek; large

scales on the opercle. Gill-rakers very short, 8 on lower part of anterior arch. Dorsal XVI 12–13; last spine longest, $\frac{1}{2}$ length of head. Pectoral pointed, a little longer than the head, extending as far as origin of anal. Ventral not reaching vent. Anal III 9–10; third spine as long as middle dorsals. Caudal rounded. Caudal peduncle not longer than deep. Scales cycloid, 30–32 $\frac{3}{12-13}$; lat. l. $\frac{20-22}{12-13}$. Body without distinct markings; snout and a spot on the opercle blackish; dorsal fin with blackish spots and oblique bars.

Total length 220 millim.

Upper Shiré River.

37. TILAPIA AFFINIS.

Tilapia affinis, A. Dum. Arch. Mus. x. 1859, p. 255.

Chromis affinis, Rochebr. Act. Soc. Linn. Bord. vi. 1883, p. 131.

Chromis aureus, Steind. Verh. zool.-bot. Ges. Wien, xiv. 1864, p. 229, pl. viii. fig. 5.

Teeth small, in 3 or 4 regular series in both jaws. Depth of body $2\frac{2}{5}$ to $2\frac{2}{3}$ in total length, length of head 3. Snout with straight upper profile, $1\frac{1}{3}$ to $1\frac{1}{2}$ diameter of eye, which is contained 4 times in length of head, and $1\frac{1}{5}$ to $1\frac{1}{2}$ in interorbital width; mouth nearly $\frac{2}{3}$ width of head, extending to below anterior border of eye; 3 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 8 or 9 on lower part of anterior arch. Dorsal XV 11–12; last spine longest, $\frac{1}{2}$ length of head, nearly $\frac{1}{2}$ longest soft rays. Pectoral pointed, $1\frac{1}{4}$ length of head, extending to origin of anal. Ventral reaching origin of anal. Anal III 8–10; third spine a little shorter than last dorsal. Caudal rounded. Caudal peduncle slightly deeper than long. Scales cycloid, 32 $\frac{3-4}{10-12}$; lat. l. $\frac{19}{12}$. Olive, a black opercular spot; soft dorsal with blackish spots more or less confluent into oblique streaks.

Total length 170 millim.

Senegal and Niger.

38. TILAPIA BURTONI.

Chromis burtoni, Günth. Proc. Zool. Soc. 1893, p. 631, pl. lviii. fig. C.

Tilapia burtoni, Bouleng. Tr. Zool. Soc. xv. 1898, p. 5.

Teeth in 5 closely-set series, outer moderately large, inner very minute. Depth of body $2\frac{3}{4}$ in total length, length of head $2\frac{4}{5}$. Snout with slightly concave upper profile, $1\frac{1}{3}$ diameter of eye, which is contained 4 times in length of head and equals interorbital width; mouth rather large, nearly $\frac{3}{4}$ width of head, extending to below anterior border of eye; 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 10 on lower part of anterior arch. Dorsal XIV 11; spines equal from the 10th, $\frac{1}{3}$ length of head, $\frac{1}{2}$ longest soft rays. Pectoral $\frac{4}{5}$ length of head, extending as far as origin of anal. Ventral prolonged in

a filament, extending beyond origin of anal. Anal III 9; third spine a little shorter than longest dorsals. Caudal rounded. Caudal peduncle a little longer than deep. Scales cycloid, $29\ \frac{3-3\frac{1}{2}}{11}$; lat. l. $\frac{21}{10}$. Olive, a dark opercular spot; two dark bars across the upper surface of the snout; a dark streak behind the eye.

Total length 95 millim.

Lake Tanganyika.

39. Tilapia buettikoferi.

Chromis büttikoferi, Hubrecht, Notes Leyd. Mus. iii. 1881, p. 66; Steind. op. cit. xvi. 1894, p. 39.[1]

Teeth rather large (10 on each side in the outer row of the upper jaw). Depth of body 2 to $2\frac{1}{4}$ in total length, length of head 3 to $3\frac{2}{5}$. Snout as long as the eye, which is contained 3 times in length of head; 5 or 6 series of scales on the cheek. Gill-rakers short, 11 on lower part of anterior arch. Dorsal XIV–XV 15–16. Pectoral as long as or a little shorter than the head, not extending so far as origin of anal. Ventral prolonged into a filament, extending beyond origin of anal. Anal III 10–11. Caudal rounded (?). Scales cycloid, 29–30 $\frac{4-5}{10-12}$; lat. l. $\frac{20-22}{11-12}$. 8 dark bars, the first two across the head, the last two on the caudal peduncle; these bars a little broader than the spaces between them.

Total length 105 millim.

St. Paul's River, Liberia.

40. Tilapia polycentra.

Tilapia polycentra, A. Dum. Arch. Mus. x. 1859, p. 254.

Chromis polycentra, Günth. Cat. iv. p. 270 (1862).

Depth of body $2\frac{2}{3}$ in total length. 3 series of scales on the cheek. 9 gill-rakers on lower part of anterior arch. Dorsal XVIII 8. Anal III 7. Caudal rounded. Scales cycloid, $24\ \frac{3\frac{1}{2}}{\times}$. Scales finely dotted with blackish; soft dorsal with alternating series of dark and light spots and a large black spot in front.

Total length 100 millim.

Gorea.

41. Tilapia kirki.

? *Ctenochromis strigigena*, Pfeffer, Jahrb. Hamb. wiss. Anst. x. 1893, p. 155, pl. ii. figs. 5–8.

Chromis kirkii, Günth. Proc. Zool. Soc. 1893, p. 624, pl. lvi. fig. A (1894).

? *Chromis strigigena*, Pfeffer, Thierw. O.-Afr., Fische, p. 18, fig. (1896).

[1] I am indebted to Dr. van Lidth de Jeude for notes supplementing the descriptions quoted.

Ctenochromis kirkii, Pfeffer, l. c. p. 19.
Tilapia kirkii, Bouleng. Tr. Zool. Soc. xv. 1898, p. 4.

Teeth small, in 3 or 4 series in both jaws. Depth of body $2\frac{2}{5}$ to $2\frac{3}{4}$ in total length, length of head 3 times. Snout with straight upper profile, $1\frac{1}{4}$ to $1\frac{2}{3}$ diameter of eye, which is $3\frac{1}{2}$ to 4 times in length of head and equal to or a little less than interorbital width; mouth $\frac{3}{5}$ to $\frac{2}{3}$ width of head; maxillary extending to below nostril or between nostril and eye; 3 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 11 or 12 on lower part of anterior arch. Dorsal XV-XVII 9–11; last spine longest, about $\frac{1}{2}$ length of head, not or but little shorter than the soft rays. Pectoral pointed, as long as or a little shorter than the head. Ventral reaching vent or a little beyond. Anal III 8–10; third spine a little shorter than longest dorsal. Caudal truncate or feebly emarginate, the rays covered with small scales. Caudal peduncle $1\frac{1}{4}$ to $1\frac{1}{3}$ as long as deep. Scales finely denticulate on the border, 33–34 $\frac{3\frac{1}{2}-4\frac{1}{2}}{11-12}$; lat. l. $\frac{20-24}{12-16}$. Brownish above, silvery beneath, with a blackish stripe from the opercular spot to the root of the caudal; a second stripe may be present between the upper lateral line and the dorsal fin; both these stripes may be broken up into spots; soft dorsal and caudal with small dark and light spots forming more or less regular series.

Total length 150 millim.

Upper Shiré River and Lake Nyassa. *C. strigigena* is founded on young specimens from Mbuzini, German East Africa.

42. TILAPIA LETHRINUS.

Chromis lethrinus, Günth. Proc. Zool. Soc. 1893, p. 622, pl. lv. fig. A.
Tilapia lethrinus, Bouleng. Tr. Zool. Soc. xv. 1898, p. 4.

Teeth very small, in 3 or 4 series in both jaws. Depth of body nearly equal to length of head, $2\frac{2}{5}$ to $2\frac{3}{4}$ in total length. Snout long, with straight upper profile, $1\frac{2}{3}$ to 2 diameter of eye, which is 4 to $4\frac{1}{2}$ times in length of head and equals interorbital width; mouth small, $\frac{1}{2}$ width of head; maxillary extending to between nostril and eye; 3 series of scales on the cheek; large scales on the opercle. Gill-rakers large, falciform, 8 or 9 on lower part of anterior arch. Dorsal XV-XVI 10–11; last spine longest, not $\frac{1}{2}$ length of head, about $\frac{3}{4}$ length of soft rays. Pectoral pointed, a little shorter than the head. Ventral reaching vent or origin of anal. Anal III 8–9; third spine shorter and stronger than longest dorsal. Caudal with crescentic emargination, the rays covered wilh small scales. Caudal peduncle $1\frac{1}{3}$ as long as deep. Scales finely denticulate on the border, 33–34 $\frac{3-4}{10-11}$; lat. l. $\frac{26}{14-19}$. Silvery, brownish on the back; some blackish spots or a black stripe above the upper lateral line; a blackish stripe may be present along the side of the body and above the lower lateral line; dorsal and caudal chequered with blackish between the rays,

the spots having a tendency to form oblique stripes on the soft dorsal.

Total length 180 millim.

Lake Nyassa.

43. TILAPIA JOHNSTONI.

Chromis subocularis, part., Günth. Proc. Zool. Soc. 1893, p. 621, pl. liv. fig. B.

Chromis johnstoni, Günth. l. c. p. 622, fig. A.

Chromis tetrastigma, Günth. l. c. p. 623, fig. C.

Tilapia subocularis, Bouleng. Tr. Zool. Soc. xv. 1898, p. 4.

Tilapia johnstoni, Bouleng. l. c.

Tilapia tetrastigma, Bouleng. l. c.

Teeth in 4 or 5 series, the outer moderately large and separated by a considerable interspace from the others, which are very minute and conical. Depth of body nearly equal to length of head, $2\frac{3}{4}$ to 3 times in total length. Snout with straight upper profile, $1\frac{1}{3}$ to $1\frac{1}{2}$ diameter of eye, which is $3\frac{2}{3}$ to 4 times in length of head and equal to or somewhat greater than interorbital width; mouth $\frac{3}{5}$ width of head; maxillary extending to between nostril and eye; 3 or 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, mostly notched, 11 or 12 on lower part of anterior arch. Dorsal XIV–XVI 10–11; last spine longest, $\frac{2}{3}$ to $\frac{1}{1}$ length of head, $\frac{3}{4}$ longest soft rays. Pectoral pointed, as long as or a little shorter than the head, extending to origin of anal. Ventral reaching vent or anal. Anal III 8–9; third spine a little shorter than longest dorsal. Caudal slightly notched, pointed above, rounded below. Caudal peduncle $1\frac{1}{3}$ to $1\frac{1}{2}$ as long as deep. Scales finely denticulate on the border, 32–33 $\frac{3-4}{11-13}$; lat. l. $\frac{20-23}{14-16}$. Pale olive, with 6 to 8 more or less regular dark bars, which may be accompanied or replaced by a few blackish spots; a dark opercular spot; dorsal with oblique dark streaks and rows of small pale spots; caudal with small pale spots.

Total length 115 millim.

Lake Nyassa and Upper Shiré River.

44. TILAPIA PECTORALIS.

Ctenochromis pectoralis, Pfeffer, Jahrb. Hamb. wiss. Anst. x. 1893, p. 153, pl. ii. figs. 3, 4, 7, and Thierw. O.-Afr., Fische, p. 16, fig. (1896).

Teeth in 5 rows in both jaws, inner very minute. Depth of body nearly equal to length of head, $2\frac{4}{5}$ times in total length. Snout with straight upper profile, as long as the eye, the diameter of which is contained somewhat more than 3 times in length of head and a little exceeds interorbital width; mouth extending nearly to below anterior border of eye; 3 series of scales on the cheek; larger scales on the opercle. Gill-rakers very short, 10 on lower part of anterior arch. Dorsal XV–XVI 8–9; soft rays somewhat produced. Pectoral pointed, nearly as long as head,

extending as far as origin of anal. Ventral reaching origin of anal. Anal III 8. Caudal truncate. Caudal peduncle as long as deep. Scales with denticulate edge, 30 $\frac{4}{10}$; lat. l. $\frac{21-22}{8-12}$. Brownish with 10 to 12 dark bars; a dark opercular spot; dark streaks and a large white, dark-edged ocellus on the soft dorsal and on the anal.

Total length 63 millim.

Korogwe, German East Africa.

45. TILAPIA NUCHISQUAMULATA.

Chromis nuchisquamulatus, Hilgend. Sitzb. Ges. naturf. Fr. 1888, p. 76.

Chromis (*Haplochromis*) *obliquidens*, Hilgend. l. c.[1]

Ctenochromis nuchisquamulatus, Pfeff. Thierw. O.-Afr., Fische, p. 14.

Ctenochromis sauvagei, Pfeff. l. c. p. 15.

Ctenochromis obliquidens, Pfeff. Arch. f. Nat. lxiii. 1897, p. 60.

Tilapia nuchisquamulata, Bouleng. Tr. Zool. Soc. xv. 1898, p. 5.

Tilapia sauvagii, Bouleng. l. c.

Tilapia obliquidens, Bouleng. l. c.

Teeth small, in 5 to 8 rows. Depth of body 2$\frac{1}{2}$ to 2$\frac{4}{7}$ times in total length, length of head about 3 times. Snout with straight upper profile, a little longer than the eye, which is 3$\frac{1}{2}$ to 3$\frac{3}{4}$ times in length of head, and equals or a little exceeds interorbital width; mouth with thick and broad lips, extending to below anterior border of eye or slightly beyond; 3 or 4 series of scales on the cheek; large scales on the opercle. 10 gill-rakers on lower part of anterior arch. Dorsal XVI 8–10; last spine longest, about $\frac{2}{3}$ length of head. Pectoral pointed, extending to origin of anal or a little beyond. Ventral reaching vent or anal. Anal III 8–9. Scales ctenoid, 28–31 $\frac{6-7}{11-12}$; scales on occiput and nape very small. Olive or brownish, with more or less distinct dark cross-bars, with or without a dark lateral stripe; a dark opercular spot; soft dorsal with dark and light spots; three or four round white spots on the posterior half of the anal; ventrals black.

Total length 125 millim.

Victoria Nyanza.

46. TILAPIA ROSTRATA, sp. n. (Plate XII. fig. 1.)

Teeth very small, in 4 series in both jaws. Depth of body 3$\frac{1}{3}$ times in total length, length of head 2$\frac{3}{4}$. Snout very long and pointed, with slightly concave upper profile, twice as long as diameter of eye, which is 4$\frac{1}{2}$ in length of head and equals interorbital width; mouth $\frac{3}{5}$ width of head; maxillary extending to between nostril and eye; 3 series of scales on the cheek; large scales on the opercle. Gill-rakers rather long and slender, 21 on

[1] I am indebted to the kindness of Prof. Hilgendorf for notes on the type specimen.

lower part of anterior arch. Dorsal XVI 11; last spine longest, $\frac{2}{3}$ length of head, a little shorter than soft rays. Pectoral pointed, $\frac{2}{3}$ length of head, not extending as far as origin of anal. Ventral reaching vent. Anal III 9; third spine a little shorter than last dorsal. Caudal rather deeply emarginate. Caudal peduncle $1\frac{1}{2}$ as long as deep. Scales with finely denticulate edge, $35\frac{4-5}{14}$; lat. l. $\frac{23-24}{19-21}$. Pale brown above, silvery white beneath; five dark brown cross-bars, broken up into large spots; a small dark brown opercular spot; a large brown spot at base of caudal; fins white.

Total length 105 millim.

A single specimen from Lake Nyassa. Collected by Miss M. Woodward; presented by Miss S. C. McLaughlin.

47. Tilapia williamsi.

Chromis williamsi, Günth. Proc. Zool. Soc. 1893, p. 624, pl. lvi. fig. C.

Tilapia williamsi, Bouleng. Tr. Zool. Soc. xv. 1898, p. 4.

Teeth moderate, in 5 or 6 closely-set series in both jaws. Depth of body equal to length of head, 3 times in total length. Snout with slightly convex upper profile, $1\frac{1}{3}$ diameter of eye, which is 4 times in length of head and $1\frac{1}{3}$ in interorbital width; mouth $\frac{2}{3}$ width of head; maxillary extending to below anterior border of eye; 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 10 on lower part of anterior arch. Dorsal XVII 8; last spine longest, nearly $\frac{1}{2}$ length of head, $\frac{3}{4}$ longest soft rays. Pectoral obtusely pointed, $\frac{3}{4}$ length of head, not extending to origin of anal. Ventral reaching vent. Anal III 7; third spine a little shorter than last dorsal. Caudal rounded, basal half densely scaled. Caudal peduncle slightly longer than deep. Scales finely denticulate on the border, $31\frac{5-7}{13}$; lat. l. $\frac{23}{11}$. Dark brown, with scattered blackish spots; a blackish opercular spot; a round blackish spot at the root of the caudal; fins grey, dorsal broadly edged with black; two small round white spots on the posterior part of the anal.

Total length 105 millim.

Lake Nyassa.

48. Tilapia callipterа.

Chromis callipterus, Günth. Proc. Zool. Soc. 1893, p. 623, pl. lv. fig. B (1894); Bouleng. op. cit. 1896, p. 916.

Chromis subocularis, part., Günth. l. c. p. 621.

Ctenochromis callipterus, Pfeffer, Thierw. O.-Afr., Fische, p. 19.

Tilapia calliptera, Bouleng. Tr. Zool. Soc. xv. 1898, p. 4.

Teeth small, in 3 to 5 series in both jaws. Depth of body $2\frac{2}{3}$ to $2\frac{4}{5}$ in total length, length of head $2\frac{3}{4}$ to 3 times. Snout with straight upper profile, $1\frac{1}{4}$ to $1\frac{1}{2}$ diameter of eye, which is $3\frac{1}{2}$ to 4 times in length of head and equal to or a little less than interorbital width; mouth $\frac{2}{3}$ to $\frac{3}{4}$ width of head; maxillary extending

to below anterior border of eye; 3 or 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 8 to 10 on lower part of anterior arch. Dorsal XIV–XVI 8–10; last spine longest, $\frac{2}{5}$ to $\frac{1}{2}$ length of head, $\frac{2}{3}$ to $\frac{4}{5}$ longest soft rays. Pectoral pointed, $\frac{3}{4}$ to $\frac{4}{5}$ length of head, not extending quite so far as origin of anal. Ventral reaching origin of anal or a little beyond. Anal III 7–8; third spine as long as or a little shorter than longest dorsal. Caudal rounded. Caudal peduncle as long as deep. Scales finely denticulate on the border, 30–33 $\frac{3-4}{11-12}$; lat. l. $\frac{19-22}{10-13}$. Brown or olive, with more or less distinct dark and light spots on the soft dorsal and caudal; anal often with a few large round white spots; a dark band from below the eye to the angle of the mouth; a dark opercular spot.

Total length 140 millim.

Shiré River and Lake Nyassa.

49. TILAPIA MONTEIRI, sp. n.

Teeth in outer row moderate, separated by an interspace from a band of 5 transverse series of minute closely-set teeth. Depth of body equal to length of head, 3 times or not quite 3 times in total length. Snout with straight upper profile, $1\frac{1}{4}$ diameter of eye, which is $3\frac{1}{2}$ in length of head and slightly exceeds interorbital width; mouth rather large, $\frac{3}{4}$ width of head; maxillary extending to below anterior border of eye or slightly beyond; 4 or 5 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 10 on lower part of anterior arch. Dorsal XIV–XV 10–11; spines equal in length from the 5th, $\frac{1}{3}$ length of head, a little more than $\frac{1}{2}$ length of longest soft rays. Pectoral pointed, $\frac{3}{4}$ length of head, not extending to origin of anal. Ventral reaching origin of anal. Anal III 6–7. Caudal rounded, densely scaled at the base. Caudal peduncle a little deeper than long. Scales mostly with finely denticulate edge, 30 $\frac{3-4}{12}$; lat. l. $\frac{19-20}{12}$. Brownish; soft dorsal with oblique dark streaks.

Total length 95 millim.

Congo. A single specimen collected by the late J. J. Monteiro. A second specimen of the same size, from Matadi, forms part of the collections made by order of the Congo Free State.

50. TILAPIA FASCIATA.

Chromis fasciatus, Perugia, Ann. Mus. Genova, (2) x. 1892, p. 970.

Three series of teeth in the jaws, outer moderately large, inner very minute. Depth of body equal to length of head, $2\frac{1}{2}$ to $2\frac{2}{3}$ in total length. Snout with straight upper profile, as long as the eye, the diameter of which is 3 times in length of head and exceeds interorbital width; 3 or 4 series of scales on the cheek; mouth small, maxillary reaching to between nostril and eye. Gill-rakers short, slender, 10 on lower part of anterior arch. Dorsal XV 10–11;

spines equal in length from the fourth or fifth; soft rays produced, the longest twice as long as the longest spines. Pectoral obtusely pointed, $\frac{2}{3}$ to $\frac{3}{4}$ length of head, not extending to origin of anal. Ventral reaching origin of anal. Anal III 6–7; third spine as long as longest dorsal. Caudal rounded. Caudal peduncle as long as deep. Scales ctenoid, 29–30 $\frac{3-4}{12}$; lat. l. $\frac{19-20}{10-14}$. Yellowish, uniform or with 8 or 9 dark bars.

Total length 45 millim.

Lower Congo.

51. Tilapia acuticeps.

Chromis acuticeps, Steind. Verh. zool.-bot. Ges. Wien, xvi. 1866, p. 764.

Teeth very small, in 2 series. Depth of body a little less than length of head, about 3 times in total length. Snout with straight upper profile, $1\frac{1}{3}$ diameter of eye, which is 4 times in length of head and equals interorbital width; mouth moderate, $\frac{2}{3}$ width of head; maxillary extending to between nostril and eye; 4 or 5 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 9 on lower part of anterior arch. Dorsal XIV–XV 10–11; last spine longest, about $\frac{2}{3}$ length of head and $\frac{3}{4}$ longest soft rays. Pectoral obtusely pointed, about $\frac{2}{3}$ length of head, not extending to origin of anal. Ventral reaching vent. Anal III 8–9; third spine nearly as long as last dorsal. Caudal rounded. Caudal peduncle as long as deep. Scales ctenoid, 30 $\frac{4}{11}$; lat. l. $\frac{18-22}{12}$. Yellowish brown, with several dark bars; a black opercular spot; a dark streak from below the eye to the angle of the mouth; vertical fins with small blackish spots, forming oblique streaks on the soft anal.

Total length 85 millim.

Angola and district of the Victoria Falls.

52. Tilapia livingstonii, sp. n. (Plate XI. fig. 2.)

Teeth in 6 series in both jaws, outer moderately large and bicuspid, inner very small, closely-set, and tricuspid. Depth of body scarcely greater than length of head, 3 times in total length; snout descending in a strong curve, as long as the eye, the diameter of which is $3\frac{1}{2}$ times in length of head and slightly exceeds interorbital width; mouth moderately large, $\frac{3}{4}$ width of head, extending to below anterior border of eye; 3 or 4 series of scales on the cheek; larger scales on the opercle. Gill-rakers short, 8 on lower part of anterior arch. Dorsal XVII 9; last spine longest, not quite $\frac{1}{2}$ length of head, $\frac{3}{4}$ longest soft rays. Pectoral pointed, $\frac{3}{4}$ length of head, not extending to origin of anal. Ventral reaching origin of anal. Anal III 8; third spine a little shorter than last dorsal. Caudal rounded. Caudal peduncle as long as deep. Scales with strongly denticulate edge, 33 $\frac{5-6}{12}$; lat l. $\frac{22-23}{11-12}$. Brownish above, with 7 dark bars, the first on the nape, the penultimate on

the caudal peduncle, the last on the root of the caudal fin; two round white spots on the anal fin.

Total length 73 millim.

A single specimen, collected by Dr. Livingstone on the Zambesi Expedition.

53. TILAPIA DESFONTAINESI. (Plate XI. fig. 3.)

Labrus desfontainii, Lacép. Hist. Poiss. iv. pp. 54 & 160 (1802).

Sparus (?) *desfontainii*, Gervais, Zool. Pal. Gén. p. 208, pl. xlv. fig. 4 (1869).

Chromis desfontainii, Sauvage, Bull. Soc. Philom. (7) i. 1877, p. 160; Vincig. Ann. Mus. Genova, xx. 1884, p. 429; Rolland, Rev. Scientif. (4) ii. 1894, p. 418, fig.

Teeth in 3 series in both jaws, outer moderately large, uni- or bicuspid, inner very minute. Depth of body $2\frac{1}{4}$ to $2\frac{1}{2}$ in total length, length of head $2\frac{3}{5}$ to $2\frac{4}{5}$. Snout with straight upper profile, $1\frac{1}{3}$ to $1\frac{1}{2}$ diameter of eye, which is 4 to $4\frac{1}{2}$ times in length of head and equal to or slightly less than the interorbital width; mouth moderate, $\frac{3}{5}$ to $\frac{2}{3}$ width of head; maxillary extending to below anterior border of eye; 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, tubercle-like, 7 or 8 on lower part of anterior arch. Dorsal XV–XVI 10–11; last spine longest, $\frac{2}{3}$ to $\frac{1}{2}$ length of head, $\frac{3}{5}$ to $\frac{2}{3}$ longest soft rays. Pectoral obtusely pointed, $\frac{2}{3}$ to $\frac{3}{4}$ length of head, not extending to origin of anal. Ventral reaching vent or origin of anal. Anal III–IV 8–10; third spine shorter and stronger than last dorsal. Caudal rounded. Caudal peduncle as long as deep. Scales ctenoid, 30–33 $\frac{4-5}{14-16}$; lat. l. $\frac{17-21}{9-15}$. Brownish or olive; a more or less distinct dark streak from below the eye to the angle of the mouth; a dark opercular spot; vertical fins with small dark and light spots; ventrals black.

Total length 90 millim.

Algerian and Tunisian Sahara.

This species links *Tilapia* with *Paratilapia*. In some specimens, as observed by Sauvage, nearly all the outer teeth are conical and unicuspid, whilst in others all or most of the outer teeth are provided with a lateral cusp situated on the outer side at a considerable distance from the apex.

54. TILAPIA FLAVII-JOSEPHI.

Chromis flavii-josephi, Lortet, Arch. Mus. Lyon, iii. 1883, p. 141, pl. viii. fig. 2.

Teeth as in *T. desfontainesi*. Depth of body equal to length of head, $2\frac{3}{4}$ in total length. Snout with straight upper profile, $1\frac{1}{3}$ to $1\frac{1}{2}$ diameter of eye, which is 4 to $4\frac{1}{2}$ times in length of head and equals interorbital width; mouth large, $\frac{3}{5}$ to $\frac{3}{4}$ width of head; maxillary extending to below anterior border of eye; 3 or 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 8 on lower part of anterior arch. Dorsal XIV–XV 8–9;

last spine longest, $\frac{2}{5}$ length of head, $\frac{2}{3}$ longest soft rays. Pectoral obtusely pointed, $\frac{2}{5}$ length of head, not extending to origin of anal. Ventral reaching origin of anal. Anal III 7; third spine shorter and stronger than last dorsal. Caudal rounded. Caudal peduncle as long as deep. Scales ctenoid, 26–27 $\frac{3}{13}$; lat. l. $\frac{17-18}{9-10}$. Pale greenish above, silvery beneath; a blackish bar below the eye; brown stripes on the snout and between the eyes, two continuous or interrupted brown stripes along the body, two brown spots on the tail, and a few round, yellow, brown-edged spots on the anal fin.

Total length 120 millim.

Syria, around Lake of Galilee.

55. TILAPIA PHILANDER.

Chromis (*Ctenochromis*) *philander*, M. Weber, Zool. Jahrb., Syst. x. 1897, p. 148.

Teeth in 3 series in both jaws, outer moderately large, with strong lateral cusp, inner very minute. Depth of body equal to or a little less than length of head, which is contained $2\frac{2}{5}$ to $2\frac{2}{3}$ in total length. Snout with slightly convex upper profile, a little longer than the eye, which is contained nearly 4 times in length of head and equals interorbital width; mouth moderate, $\frac{2}{3}$ width of head; maxillary extending to below anterior border of eye; 3 series of scales on the cheek; large scales on the opercle. Gill-rakers short, tubercle-like, 8 on lower part of anterior arch. Dorsal XIII–XIV 9–10; spines subequal from the third, a little more than $\frac{1}{3}$ length of head, $\frac{2}{3}$ to $\frac{3}{4}$ longest soft rays. Pectoral obtusely pointed, $\frac{2}{3}$ length of head, not extending to origin of anal. Ventral reaching vent or origin of anal. Anal III 8–10; third spine nearly as long as longest dorsal. Caudal rounded. Caudal peduncle as long as deep. Scales ctenoid, 27–28 $\frac{2\frac{1}{2}-3}{11}$; lat. l. $\frac{15-16}{6-9}$. Olive-brown, with an indistinct darker lateral stripe; a blackish opercular spot; soft dorsal and anal with small dark and light spots.

Total length 55 millim.—Grows to 65 millim.

Natal, Transvaal.

56. TILAPIA LABIATA.

Tilapia labiata, Bouleng. Tr. Zool. Soc. xv. 1898, p. 17, pl. v. fig. 1.

Outer teeth rather large, feebly notched; inner teeth very small, tricuspid, in 3 or 4 series. Depth of body equal to length of head, $2\frac{2}{3}$ to $2\frac{3}{4}$ times in total length. Snout with straight upper profile, $1\frac{1}{4}$ to $1\frac{3}{4}$ diameter of eye, which is $3\frac{1}{2}$ to $4\frac{1}{2}$ times in length of head and equals interorbital width; maxillary not extending to below anterior border of eye; 3 or 4 series of scales on the cheek; large scales on the opercle; lips very strongly developed, both produced into a large triangular lobe in front. Gill-rakers moderate, 15 on lower part of anterior arch. Dorsal XVIII 10;

middle dorsal spines longest, about $\frac{2}{5}$ length of head and a little shorter than longest soft rays. Pectoral $\frac{3}{4}$ to $\frac{4}{5}$ length of head, extending to origin of anal. Ventral reaching origin of anal. Anal III 6–7; third spine longest, as long as longest dorsals, slightly shorter than longest soft rays. Caudal truncate. Caudal peduncle slightly longer than deep. Scales finely denticulate on the border, 33–35 $\frac{5-6}{12-13}$; lat. l. $\frac{22-25}{13-15}$. Pale olive, with 10 more or less distinct darker cross-bars; fins greyish brown; dorsal sometimes with oblique dark and light streaks; caudal with numerous round dark spots between the rays.

Total length 170 millim.

Lake Tanganyika.

57. TILAPIA ZEBRA, sp. n. (Plate XII. fig. 2.)

Teeth very small, in 4 or 5 series in both jaws. Depth of body $2\frac{3}{4}$ times in total length, length of head $3\frac{1}{5}$. Snout with straight upper profile, $1\frac{1}{3}$ diameter of eye, which is 4 times in length of head and $1\frac{1}{3}$ in interorbital width; mouth rather large, $\frac{3}{4}$ width of head; maxillary extending to below anterior border of eye; 5 or 6 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 12 on lower part of anterior arch. Dorsal XVIII 8; last spine longest, $\frac{1}{2}$ length of head, $\frac{3}{5}$ middle soft rays, which are produced. Pectoral pointed, as long as head, not extending as far as origin of anal. Outer ray of ventral produced, filiform, extending beyond origin of anal. Anal III 8; third spine nearly as long as last dorsal. Caudal rounded (?), densely scaled at the base. Caudal peduncle a little deeper than long. Scales with finely denticulate edge, 31 $\frac{6-7}{16}$; lat. l. $\frac{23-24}{10-11}$; scales on occiput and nape very small. Grey, with six dark brown bars; a crescentic dark brown band on the forehead, from eye to eye, followed by a second further back, and a third in front of the dorsal; vertical fins grey; three round white spots on the posterior part of the anal; ventrals blackish.

Total length 105 millim.

A single specimen from Lake Nyassa. Collected by Miss M. Woodward; presented by Miss S. C. McLaughlin.

58. TILAPIA AURATA. (Plate XII. fig. 3.)

Chromis auratus, Bouleng. Ann. & Mag. N. H. (6) xix. 1897, p. 155.

Tilapia aurata, Bouleng. Tr. Zool. Soc. xv. 1898, p. 4.

Teeth small, in 5 or 6 closely-set series in both jaws. Depth of body $3\frac{2}{3}$ in total length, length of head $3\frac{1}{4}$. Snout short, profile curved; diameter of eye 4 times in length of head, slightly greater than interorbital width; mouth small, $\frac{3}{5}$ width of head, extending to between nostril and eye; 3 series of scales on the cheek; large scales on the opercle. Gill-rakers very short, 8 on lower part of anterior arch. Dorsal XIX 6; spines subequal in length from the 4th, $\frac{1}{3}$ length of head, $\frac{1}{5}$ longest soft rays. Pectoral

pointed, $\frac{3}{4}$ length of head, not extending to origin of anal. Ventral reaching vent. Anal III 6; third spine as long as longest dorsals. Caudal truncate, densely scaled. Caudal peduncle a little longer than deep. Scales with finely denticulate border, $34\ \frac{5-6}{12}$; lat. l. $\frac{24}{12}$. Bright golden yellow, with three black stripes, one along the side of the body from the eye to the base of the caudal, a second above the upper lateral line from the occiput to the caudal peduncle, and a third along the dorsal fin; two curved black bands across the snout from eye to eye; a few black spots on the upper part of the caudal fin.

Total length 75 millim.

Lake Nyassa.

59. TILAPIA OLIGACANTHUS.

Tilapia oligacanthus, Bleek. Versl. Ak. Amsterd. ii. 1868, p. 309; Bleek. & Pollen, Poiss. Madag. p. 11, pl. iv. fig. 1 (1874).

Ptychochromis oligacanthus, Steind. Sitzb. Ak. Wien, lxxxii. i. 1880, p. 249, pl. i.; Sauvage, Hist. Madag., Poiss. p. 439, pls. xliv. fig. 4, xliv B. fig. 1, & xlv. fig. 1 (1891).

Teeth in 3 series in both jaws, of outer row moderate, of inner rows very small. Depth of body $2\frac{1}{5}$ to $2\frac{1}{3}$ in total length, length of head $2\frac{2}{3}$ to 3. Snout with straight or slightly convex upper profile, $1\frac{1}{3}$ diameter of eye, which is $3\frac{1}{2}$ to 4 times in length of head and equals interorbital width; mouth moderate, $\frac{2}{3}$ diameter of eye, extending to between nostril and eye; 4 or 5 series of scales on the cheek; larger scales on the opercle. Gill-rakers short, 12 or 13 on lower part of anterior arch. Dorsal XIII–XIV 11–12; last spine longest, $\frac{2}{5}$ to $\frac{1}{2}$ length of head, $\frac{2}{3}$ to $\frac{3}{4}$ longest soft rays. Pectoral pointed, as long as the head or a little shorter, not extending so far as origin of anal. Ventral reaching vent or a little beyond. Anal III 8–9; third spine longer than last dorsal. Caudal with rather deep crescentic emargination. Caudal peduncle as long as deep. Scales with finely denticulate border, 32–34 $\frac{3\frac{1}{2}-4\frac{1}{2}}{14-15}$; lat. l. $\frac{21-22}{12-15}$. Olive or brownish above, with five dark bars or two or three large dark spots on each side.

Total length 135 millim.

Madagascar.

60. TILAPIA MADAGASCARIENSIS.

Ptychochromis madagascariensis, Sauvage, Hist. Madag., Poiss. p. 442, pls. xliii. fig. 4 & xliv A. fig. 6 (1891).

Teeth in 4 or 5 closely-set series, of outer row moderate, of inner rows very small. Depth of body 2 to $2\frac{1}{5}$ in total length, length of head 3. Snout with straight or slightly convex upper profile, $1\frac{1}{2}$ to $1\frac{2}{3}$ diameter of eye, which is 4 times in length of head and $1\frac{1}{4}$ to $1\frac{1}{3}$ in interorbital width; mouth moderate, $\frac{2}{3}$ diameter of eye, extending to between nostril and eye; 4 or 5 series of scales on the cheek; larger scales on the opercle. Gill-rakers short, falciform, 12 on lower part of anterior arch. Dorsal XIII 10–13; last spine longest, $\frac{1}{2}$ to $\frac{3}{5}$ length of head; middle

soft rays much produced, as long as the head or a little longer. Pectoral pointed, as long as the head, not extending so far as origin of anal. Ventral reaching vent or origin of anal. Anal III 7–8; third spine a little longer than last dorsal; middle soft rays produced. Caudal feebly emarginate. Caudal peduncle as long as deep or slightly deeper than long. Scales with finely denticulate border, 32–34 $\frac{4-5}{14-15}$; lat. l. $\frac{21-22}{12-15}$. Uniform brown.

Total length 220 millim.

Madagascar.

61. TILAPIA GRANDIDIERI.

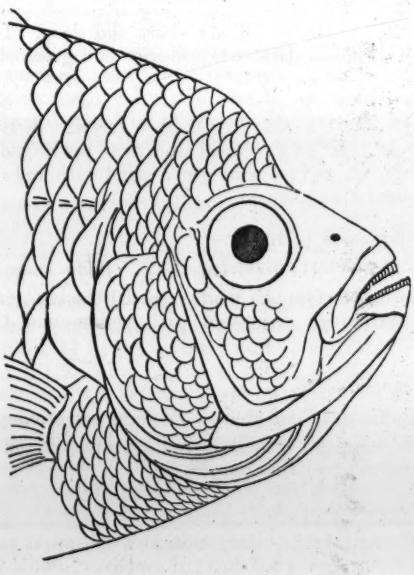
Ptychochromis grandidieri, Sauvage, Bull. Soc. Philom. (7) vi. 1882, p. 174, and Hist. Madag., Poiss. p. 441, pls. xliv. fig. 3 & xliv A. fig. 5 (1891).

Closely allied to *T. madagascariensis*, but distinguished by smaller scales, 35 $\frac{6}{16}$. D. XIII–XIV 11. A. III 7. Brown, each scale bearing a blue spot.

Total length 160 millim.

Madagascar.

62. TILAPIA BETSILEANA, sp. n.



Tilapia betsileana.

Teeth in 4 or 5 closely-set series, of outer row moderate, of

inner rows very small. Depth of body 2 to $2\frac{1}{3}$ in total length, length of head $3\frac{1}{4}$. Occiput strongly humped, forming an angle with the upper profile of the snout, which is straight and somewhat convex; snout $1\frac{1}{3}$ diameter of eye, which is $3\frac{2}{3}$ to 4 times in length of head and $1\frac{1}{2}$ in interorbital width; mouth moderate, about $\frac{2}{3}$ width of head, extending to below anterior border of eye; 5 series of scales on the cheek; larger scales on the opercle. Gill-rakers short, 11 on lower part of anterior arch. Dorsal XIV–XV 12–13; last spine longest, $\frac{2}{5}$ length of head; middle soft rays much produced, longer than the head. Pectoral pointed, as long as the head, not extending so far as origin of anal. Ventral reaching vent. Anal III 10; third spine a little longer than last dorsal; soft rays produced like the dorsals. Caudal emarginate. Caudal peduncle slightly deeper than long. Scales with finely denticulate border, 31–33 $\frac{4}{15}$.

Total length 200 millim.

Two badly preserved specimens from the collections of the Rev. W. D. Cowan in Betsileo, Madagascar.

The following species from Lake Ngami are insufficiently described by Castlenau, Mém. Poiss. Afr. Austr. (1861):—

Chromys sparmanni, p. 12.

D. XVI 12; A. III 10. Body short and deep. Dark green; anterior half of caudal dark red, posterior half greenish white.

Chromys andersoni, p. 14.

D. XVI 15; A. III 12. Teeth in 4 series. Body short and deep; pectoral very long; dorsal and anal prolonged. Blackish grey; caudal dark red; dorsal grey, edged with red; dorsal and anal with round blue spots.

Chromys chapmani, p. 15.

D. XVI 11; A. III 10. Lat. l. $\frac{22}{12}$. Body short and deep; pectoral very long. Greyish white; caudal blackish, yellow in the middle; dorsal grey, variegated with yellow and tipped with reddish.

Chromys smithi, p. 16.

Lat. l. $\frac{22}{14}$. Teeth in two rows. Pectoral not prolonged. Black above, yellow beneath; head dark red beneath; dorsal and caudal greenish; ventrals and anal purple.

Chromys levaillanti, p. 16.

D. XV 14; A. III 11. Body elongate. Pectoral rather short. Grey; head covered with red dots; dorsal grey, dotted with black; caudal dirty green; anal yellowish green, dotted with red.

15. Stratocranus Blgr.
Ann. Mus. Congo, Zool. i. p. 52 (1899).

Body moderately elongate; scales cycloid. Two series of small notched teeth in both jaws, the outer larger, with a pair of larger, truncate, incisor-like teeth at the symphysis. Maxillary exposed. An adipose crest or swelling along the vertex and occiput. Dorsal with 19 or 20 spines, anal with 3. Vertebræ 30 (16+14).

1. Stratocranus gibbiceps Blgr.
L. c. pl. xxviii. fig. 1.

Depth of body 3½ to 3⅔ times in total length, length of head 3. Snout with slightly convex upper profile, nearly twice as long as the eye, the diameter of which is 5 times in length of head and equals interorbital width; maxillary extending to below nostril; no scales on the head. Dorsal XIX–XX 8; last spine longest, ⅔ length of head, a little shorter than soft rays. Pectoral rounded, ⅔ or ¾ length of head. Ventral not reaching vent. Anal III 6. Caudal rounded. Caudal peduncle as long as deep. Scales 32–35 $\frac{3}{14}$; lat. l. $\frac{21}{10\text{-}11}$.

Total length 75 millim.

Lower Congo.

16. Docimodus Blgr.
P. Z. S. 1896, p. 917.

Body moderately elongate; scales cycloid. Both jaws with a very broad band of teeth with compressed sharp-edged crowns; the outer teeth large, with nail-shaped entire crowns or with a very small lateral cusp, the others small and tricuspid. Maxillary exposed. Dorsal with 16 or 17 spines, anal with 3. Vertebræ 32 (14+18).

1. Docimodus johnstoni Blgr.
L. c. fig.

4 or 5 rows of teeth in each jaw; 10 or 11 teeth on each side of the outer series of the upper jaw; crowns brown-edged. Depth of body 2¾ to 3 times in total length, length of head 3 times. Eye a little nearer gill-opening than tip of snout, its diameter 4½ in length of head, 1½ in interorbital width; maxillary extending to between nostril and eye; 3 or 4 series of scales on the cheek; opercle scaleless. Gill-rakers short, 11 or 12 on lower part of anterior arch. Dorsal XVI–XVII 8–9; spines increasing in length to the 5th, which is ⅔ length of head. Anal III 9–10; third spine longest, as long as last or penultimate dorsal, but much thicker. Caudal peduncle 1½ as long as deep. Scales 33–34 $\frac{3}{10}$; lat. l. $\frac{24}{15}$. A black stripe along the posterior half of the body, between the lateral lines; soft dorsal with round dark spots.

Total length 200 millim.

Upper Shiré River.

17. PERISSODUS Blgr.
Tr. Z. S. xv. p. 20.

1. PERISSODUS MICROLEPIS Blgr.
Tr. Z. S. xv. p. 21.

Lake Tanganyika.

18. PLECODUS Blgr.
Tr. Z. S. xv. p. 22

1. PLECODUS PARADOXUS Blgr.
Tr. Z. S. xv. p. 22.

Lake Tanganyika.

19. PARETROPLUS.

Paretroplus, Bleek. Versl. Ak. Amsterd. ii. 1868, p. 311; Sauvage, Hist. Madag., Poiss. p. 445 (1891).

Body short; scales cycloid. Teeth rather large, with blunt crowns, forming a single series; one or two more or less enlarged teeth on each side at the symphysis of either jaw. Maxillary exposed. Dorsal with 16 to 20 spines, anal with 8 to 10; the spines folding in a scaly basal sheath. Vertebræ 34 (17+17).

Madagascar. Two species.

1. PARETROPLUS DAMI.

Paretroplus damii, Bleek. l. c. p. 313; Bleek. & Pollen, Poiss. Madag. p. 13, pl. iv. fig. 3 (1874); Sauvage, Hist. Madag., Poiss. p. 446, pl. xlvi. fig. 1 (1891).

Depth of body twice in total length, length of head 3 times. Snout strongly compressed, twice as long as the eye in the adult; diameter of eye $4\frac{1}{2}$ times in length of head, $1\frac{1}{2}$ in interorbital width; maxillary extending to between nostril and eye; 4 series of scales on the cheek; larger scales on the opercle. Gill-rakers short, 12 on lower part of anterior arch. Dorsal XVIII–XX 11–14; last spine longest, $\frac{2}{5}$ length of head, shorter than soft rays. Pectoral obtusely pointed, not quite $\frac{3}{4}$ length of head. Anal IX–X 9–11; last spine slightly longer than longest dorsal. Caudal feebly emarginate. Caudal peduncle twice as long as deep. Scales 35 $\frac{5-6}{17}$; lat. l. $\frac{23}{4-5}$; lower lateral line reduced to a few tubules, not extending to the root of the caudal. Uniform dark brown; a round blackish spot above the axil; pectoral yellowish.

Total length 170 millim.

Madagascar.

2. PARETROPLUS POLYACTIS.

Paretroplus polyactis, Bleek. Versl. Ak. Amsterd. xii. 1878, p. 195, pl. iii. fig. 1; Sauv. Hist. Madag., Poiss. p. 446, pls. xliv A. fig. 7 & xliv B. fig. 2 (1891).

Paretroplus damii (non Bleek.), Steind. Sitzb. Ak. Wien, lxxxii. i. 1880, p. 247.

Closely allied to the preceding. Depth of body $1\frac{3}{4}$ to 2 in total

length, length of head 3 times. Snout $1\frac{1}{2}$ diameter of eye, which is 4 times in length of head and $1\frac{1}{4}$ to $1\frac{1}{3}$ in interorbital width; 3 or 4 series of scales on the cheek. Dorsal XVI–XVIII 17–18. Anal VIII–IX 13–14. Caudal peduncle about $1\frac{1}{2}$ as deep as long. Scales 32–34 $\frac{4-5}{14-15}$; lat. l. $\frac{20-22}{8-10}$. Olive or brown, uniform or with very indistinct darker bars; pectoral yellowish.

Total length 165 millim.

Madagascar.

In concluding this revision, I append a table of the number of vertebræ in the 24 different forms I have been able to examine.

	Total number.	Præcaudal.	Caudal.
Lamprologus congoensis	31	15	16
Julidochromis ornatus	34	17	17
Telmatochromis temporalis	33	16	17
Hemichromis fasciatus	28	15	13
„ *bimaculatus*	26	14	12
Paratilapia polleni	27	13	14
„ *sacra*	28	15	13
„ *robusta*	36	17	19
„ *longiceps*	38	19	19
Bathybates fexox	36	17	19
Pelmatochromis subocellatus	25	13	12
Chromidotilapia kingsleyæ	27	14	13
Corematodus shiranus	32	15	17
Eretmodus cyanostictus	30	15	15
Tropheus moorii	33	17	16
Tilapia nilotica	32	17	15
„ *galilæa*	32	17	15
„ *lata*	28	15	13
„ *desfontainesii*	31	15	16
„ *oligacanthus*	28	14	14
Steatocranus gibbiceps	30	16	14
Docimodus johnstoni	32	14	18
Perissodus microlepis	35	17	18
Paretroplus polyactis	34	17	17

EXPLANATION OF THE PLATES.

Plate XI.

Fig. 1. *Tilapia mariæ* Blgr., p. 122.
2. „ *livingstonii* Blgr., p. 134.
3. „ *desfontainesi* Lacép., p. 135.

Plate XII.

Fig. 1. *Tilapia rostrata* Blgr., p. 131.
2. „ *zebra* Blgr., p. 137.
3. „ *aurata* Blgr., p. 137.

February 21, 1899.

Prof. G. B. Howes, LL.D., F.R.S., Vice-President, in the Chair.

The following papers were read :—

1. On a Portion of Mammalian Skin, named *Neomylodon listai*, from a Cavern near Consuelo Cove, Last Hope Inlet, Patagonia. By Dr. F. P. Moreno, C.M.Z.S. With a Description of the Specimen by A. Smith Woodward, F.Z.S.

[Received February 21, 1899.]

(Plates XIII.–XV.)

1. Account of the Discovery. By Dr. Moreno.

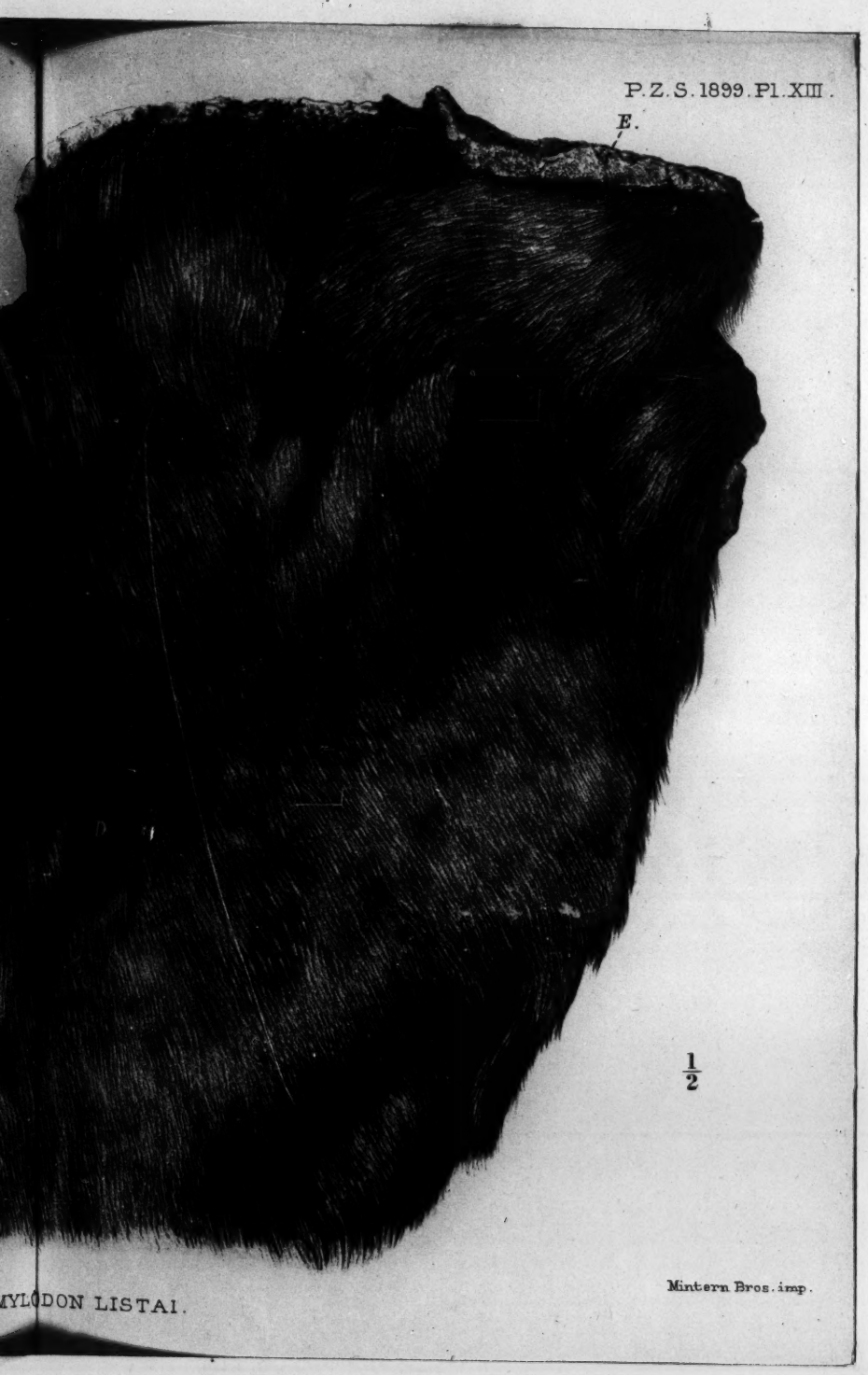
In November 1897 I paid a visit to that part of the Patagonian territory which adjoins the Cordillera of the Andes, between the 51st and 52nd degrees of South latitude, where certain surveyors, under my direction, were carrying out the preliminary studies connected with the boundary-line between Chile and Argentina; and in the course of this expedition I reached Consuelo Cove, which lies in Last Hope Inlet. In that spot, hung up on a tree, I found a piece of a dried skin, which attracted my attention most strangely, as I could not determine to what class of Mammalia it could belong, more especially because of the resemblance of the small incrusted bones it contained to those of the Pampean *Mylodon*. On inquiring whence it came, I was informed that it was only a fragment of a large piece of skin which had been discovered two years before, by some Argentine officers, in a cavern which existed in the neighbouring heights. Immediately on receiving this news, I hastened to the spot, guided by a sailor who had been present when the original discovery had been made. As, at that moment, I had no means of making more than a few hurried excavations, which gave no further traces of the discovery, I left orders that the search should be continued after my departure; but this once more also failed to give any ultimate results. Nothing could be found but modern remains of small rodents, and these chiefly on or near the surface of the ground. From the most careful inquiries which I set on foot, it appeared that, when the first discovery was made, no bones were found, the skin being half buried in the dust which had accumulated from the gradual falling away of the roof of the cavern, composed of Tertiary Conglomerate. It was only in the broad entrance to the cavern that were found a few human bones, borne thence to the shore of the Cove and afterwards broken up.

As already stated, the skin here presented to you formed but a small part of a larger one. One small piece had been carried off

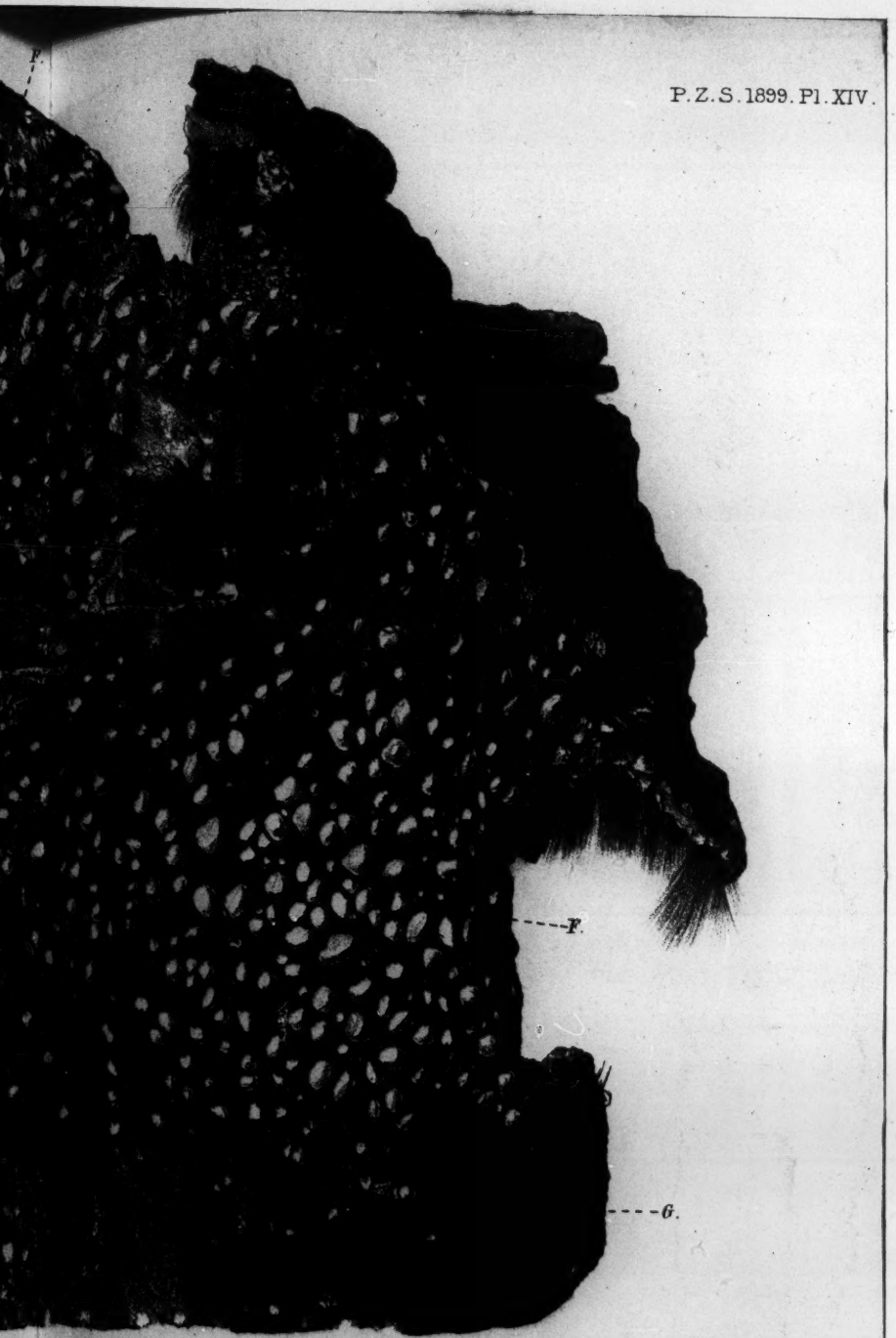
BRITISH
1 JY99
MUSEUM

J. Green del. et lith.

NEOMYLODO


P.Z.S.1899.Pl.XIII.
E.
1/2
MYLODON LISTAI.
Mintern Bros. imp.

G
F
1/2
J.Green del.et lith.
NEOMYLODO



YLODON LISTAI.

Mintern Bros. imp.

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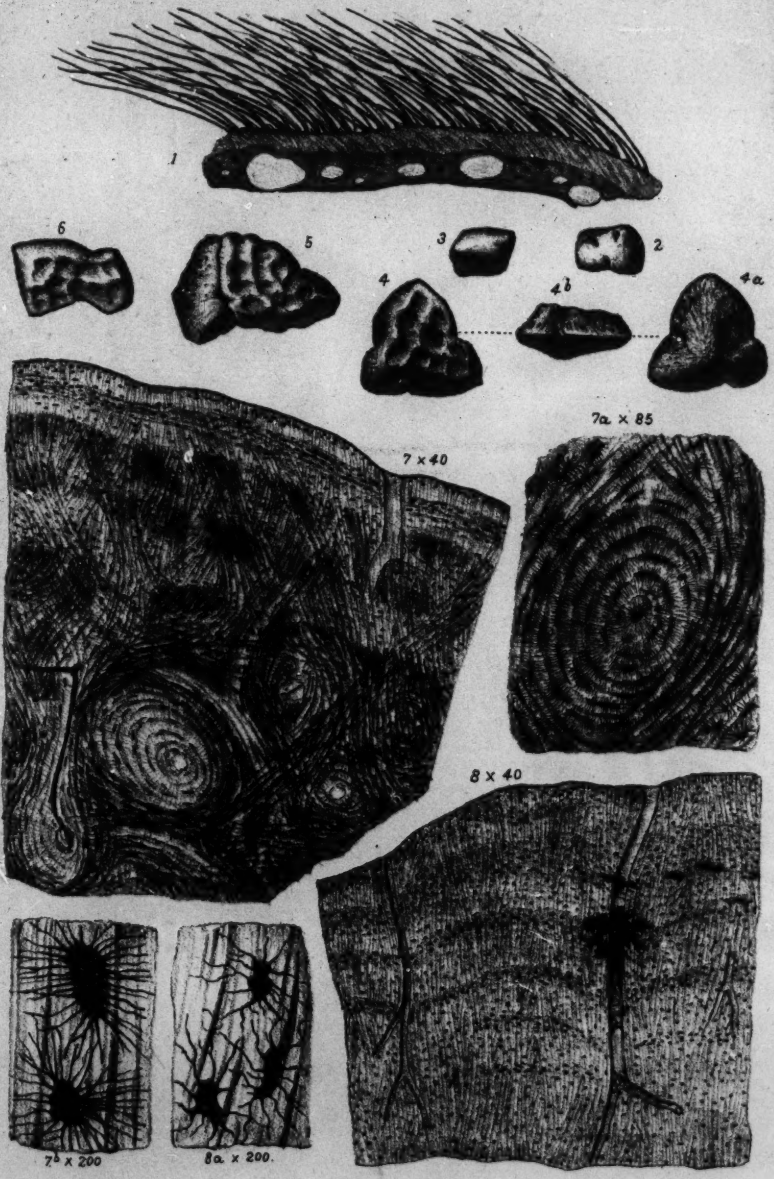

P. Highley del. et lith.

Hanhart imp.

NEOMYLODON LISTAI.

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by Dr. Otto Nordenskjöld, and others by officers of the Chilian navy, who later on had visited the spot. The inhabitants of the locality looked upon it as an interesting curiosity, some of them believing that it was the hide of a cow incrusted with pebbles, and others asserting that it was the skin of a large Seal belonging to a hitherto unknown species.

In Consuelo Cove, I embarked on board a small Argentine transport, which had been placed at my disposal to carry out the study of the western coast as far as Port Montt, in latitude 42°. At this latter place I left the steamer, which then proceeded to make a series of surveys. These lasted until her return to La Plata, at the latter end of July 1898, when she brought back to me the fragment of skin in question.

This is an accurate and true version of the discovery of this skin, which gave rise to the publication of Señor Ameghino's small pamphlet[1], in which he gave an account of the discovery of a living representative of the "Gravigrades" of Argentina, distinguishing it by the name of "*Neomylodon listai*."

I have an idea that Señor Ameghino never saw the skin itself, but only some of the small incrusted bones, of which he had obtained possession. The vague form in which he draws up his account compels me to believe this suspicion to be true.

My opinion is that this skin belongs to a genuine Pampean *Mylodon*, preserved under peculiar circumstances resembling those to which we owe the skin and feathers of the Moa. I have always maintained that the Pampean Edentates, now extinct, disappeared only in the epoch which is called the historical epoch of our America. In the province of Buenos Aires, buried chiefly in the humus, I have found remains of *Panochthus*, and others of the same *Mylodon* from the sea-shore, all of which present the same characteristic marks of preservation as the remains of human beings discovered in the same spot. In this identical layer of the sea-shore, close to the bones I have also found stones polished by the hand of man, and flints cut like those found in the Pampean formation. In 1884, in a cavern near to the Rio de los Patos, in the Cordillera, I discovered some paintings in red ochre, one of which, in my opinion, resembles the *Glyptodon* on account of the shape of the carapace.

Ancient chroniclers inform us that the indigenous inhabitants recorded the existence of a strange, ugly, huge hairy animal which had its abode in the Cordillera to the south of latitude 37°. The Tehuelches and the Gennakens have mentioned similar animals to me, of whose existence their ancestors had transmitted the remembrance; and in the neighbourhood of the Rio Negro, the aged cacique Sinchel, in 1875, pointed out to me a cave, the supposed lair of one of these monsters, called "Ellengassen"; but I must add

[1] F. Ameghino, "Première Notice sur le *Neomylodon listai*, un Représentant vivant des anciens Edentés Gravigrades fossiles de l'Argentina" (La Plata, August 1898); translated under the title "An Existing Ground-Sloth in Patagonia," in 'Natural Science,' vol. xiii. (1898), pp. 324-326.

that none of the many Indians with whom I have conversed in Patagonia have ever referred to the actual existence of animals to which we can attribute the skin in question, nor even of any which answer to the suppositions of Señor Ameghino according to Señor Lista. It is but rarely that a few Otters (*Lutra*) are found in the lakes and rivers of the Andes, as in the neighbourhood of Lake Argentino, in the 'Sierra de las Viscachas,' and in the regions which I believe Señor Lista visited, there are only a few scarce Chinchillas (*Lagidium*), which have a colouring more dark greyish than those found to the north, and are in every case separated from these by a large extent of country.

The Pampean Edentata have in former days certainly existed as far south as the extreme limit of Patagonia. In 1874, in the bay of Santa Cruz, I met with the remains of a *pelvis* of one of these animals in Pleistocene deposits, and also remains of the mammals which are found in the same formation, such as the *Macrauchenia* and *Auchenia*. It would not be astonishing that the skin of one of these should have been preserved so long, because of the favourable conditions of the spot in which it was found.

The state of preservation of this piece of skin, at first sight, makes it difficult for one to believe it to be of great antiquity; but this is by no means an impossibility, if we consider the conditions of the cave in which it was found, the atmosphere of which is not so damp as one might at first imagine it to be, although it is situated in the woody regions near to the glaciers and lakes. It is well to mention that in 1877, under similar conditions, and in a much smaller cave, scarcely five metres from the waters of Lake Argentino, situated 60 miles more to the north, I discovered a mummified human body painted red, with the head still covered in part with its short hair wonderfully preserved, and wrapped up in a covering made of the skin of a Rhea, and holding in its arms a large feather of the Condor, also painted red: this was all covered up with a layer of grass and dust fallen from the roof of the cave. In another cave in the neighbourhood I discovered a large trunk of a tree, painted with figures in red, black, and yellow. The sides of the rock close to the entrance of the cave were covered with figures, some representing the human hand, others combinations of curved, straight, and circular lines, painted white, red, yellow, and green. Now, this mummy, which is preserved in the Museum of La Plata, does not belong to any of the actual tribes of Patagonia. Its skull resembles rather one of those more ancient races found in the cemeteries in the valley of the Rio Negro—a most interesting fact, since they belong to types which have completely disappeared from the Patagonian regions, and it is well known that the actual Tehuelches may be considered to have been the last indigenous races which reached the territory of Patagonia. Many a time the Tehuelches have spoken to me of these caves as abodes of the evil "spirits," and of the enigmatical painted figures they contained: some attributed the latter to these same "spirits," others to men of other races, of whom they have no recollection. In another cave,

PHOTOGRAPH FROM INSIDE OF THE CAVERN NEAR CONSUELO COVE, LAST HOPE INLET, PATAGONIA, LOOKING OUTWARDS.

+ marks the spot where the piece of skin of *Neomylodon listai* was found buried in earth.

four hundred miles further to the north, in 1880, I discovered other human bodies, more or less mummified and in good preservation, but of a different type, and beside them some painted poles which served to hold up their small tents, the use of which had already disappeared more than three centuries ago; together with the upper part of the skull of a child perfectly scooped out like a cup. And yet the historical Tehuelches, the same as all the indigenous races in the southern extremity of South America, hold their dead in great respect, and never use such drinking-vessels.

These proofs of the favourable conditions of the climate and of the lands near to the Cordillera, which are revealed to us by the preservation of objects undoubtedly dating from very remote epochs, strengthen my opinion that this skin of a huge mammal, which has long since disappeared, may well have been preserved till the present time.

I exhibit a photograph of the cave in which the specimen was found (reproduced on the preceding page). I may add that a further careful search is now being made in the earth forming the floor of the cave, and I hope in due time to have the honour of communicating the results to this Society.

2. Description and Comparison of the Specimen. By A. Smith Woodward.

(a) *Description.*

The problematical piece of skin discovered by Dr. Moreno measures approximately 0·48 m. in the direction of the main lie of the hair, while its maximum extent at right angles to this direction is about 0·55 m. The fragment, however, is very irregular in shape; and it has become much distorted in the process of drying, so that the anterior portion, which is directed upwards in the drawing, Pl. XIII., is bent outwards at a considerable angle to the main part of the specimen which will be claimed to represent the back. The skin, as observed in transverse section, presents a dried, felt-like aspect; but there is a frequent ruddiness, suggestive of blood-stains, while the margin above the point marked B (Pl. XIII.) and to the right of E (Pl. XIII.) exhibits distinct indications of freshly dried once-fluid matter, which Dr. Vaughan Harley has kindly examined and pronounced to be serum. Its outer face is completely covered with hair, except in the region marked C and above B, where this covering seems to have been comparatively fine and may have been accidentally removed. The inner face of the skin (Pl. XIV.) is only intact in a few places (*e. g.* where marked G), the specimen having contracted and perhaps been somewhat abraded, so that a remarkable armour of small bony tubercles, irregularly arranged and of variable size, is exposed over the greater part of it, and especially well in the regions marked F. At one point, marked B in Pl. XIII., there is an irregular rounded hole about

0·02 m. in diameter, which might possibly have been caused by a bullet or a dagger, but in any case was probably pierced when the skin was still fresh. Owing to its direction, this hole is partly obscured by the overhanging hair in Pl. XIII.

The skin in its dried state varies in thickness in different parts. The average thickness of the flattened portion, which must be referred to the back, is shown by the cleanly-cut right margin of the specimen to be 0·01 m. This is slightly increased towards the posterior (lower) end of the border; while above it, at E, the thickness becomes 0·015 m. The latter thickness also seems to be attained in the much-shrivelled corner marked C—a circumstance suggesting bilateral symmetry between at least part of the two anterior outer angles of the specimen. The thinnest portion preserved is the border above B; and the skin must also have been comparatively thin in the region of the accidental notch to the left, considerably below C.

The portion of skin above B is interesting not only from its relative thinness, but also from the occurrence of an apparently natural rounded concavity in the margin. This excavation, which measures 0·05 m. along the curve, is marked by the remains of a thin flexible flap, which is sharply bent outwards, and is covered with short hairs on its outer face. It is especially suggestive of the base of an ear-conch; and if this appearance be not deceptive, it is worthy of note that the dried skin hereabouts and in the region which would have to be interpreted as cheek (C) is much more wrinkled than elsewhere.

As already mentioned, the outer aspect of the skin is completely covered with hair, which is very dense everywhere except on the left anterior corner. Here it seems to have been removed by abrasion. A small patch of hair has also clearly been pulled out near the gap in the left border of the specimen; and close to the middle (where marked D) there is a small hairless depression which may perhaps be interpreted as a wound inflicted and healed during life. The hair is only of one kind, without any trace of under-fur, and it is still very firmly implanted in the skin, without signs of decay. Its arrangement seems to be quite regular, there being no tendency towards its segregation into small groups or bundles. It is of a uniform dirty yellowish or light yellowish-brown colour, and, making due allowance for slight ruffling and distortion of the specimen, it may be described as all lying in one direction, vertically in the drawing (Pl. XIII.), except at the two upturned anterior corners of the specimen, where there is an inclination from the right and left respectively towards the centre. The longest hairs, which usually measure from 0·05 m. to 0·065 m. in length, are observed in the half of the specimen in front of (above) the letter D. Those in the middle of the extreme anterior (upper) border measure from 0·03 m. to 0·05 m. in length, those at the hinder (lower) border about the same; while some of the comparatively small and delicate hairs on the supposed cheek are not longer than 0·01 m. The hairs are stiff, straight, or only very slightly wavy,

and all are remarkably tough. Examined under the microscope, their cuticle is observed to be quite smooth, while the much-elongated cells of the cortex are readily distinguishable. Mr. R. H. Burne has kindly made some transverse sections, which prove the hairs to be almost or quite cylindrical, and none of the specimens examined present any trace of a medulla.

The dermal ossicles are very irregular in arrangement, but are to be observed in every part of the specimen, even in the comparatively thin region near the supposed ear. They form everywhere a very compact armour, and some of them are quite closely pressed together; rarely, indeed, there is a shallow groove crossing a specimen, possibly indicating two components which were originally separate. As shown by every part of the cut margin, and especially well in a small section prepared by Prof. Charles Stewart (Pl. XV. fig. 1), they are all confined to the lower half of the dermis, never encroaching upon the upper portion in which the hair is implanted. It is also to be observed that where the inner surface of the skin is intact (*e. g.* around G in Pl. XIV.), the ossicles are completely embedded and only faintly visible through the dry tissue. The exposure of a considerable number of them, as already mentioned, is due to the rupture and partial abrasion of this surface. No tendency to arrangement in parallel lines or bands can be detected; and large and small ossicles seem to be indiscriminately mingled, although of course allowance must be made, in examining sections and the abraded inner view of the skin, for differences in the plane of adjoining sections and varying degrees of exposure by the removal of the soft tissue. The largest ossicles are oblong in shape when viewed from within, and measure approximately 0·015 m. by 0·010 m.; but the majority are much smaller than these. They are very variable and irregular in form; but their inner face is generally convex, sometimes almost pyramidal, while the outer face of the few which have been examined is slightly convex, more or less flattened, without any trace of regular markings (Pl. XV. figs. 2, 3).

In microscopical structure the dermal ossicles are of much interest, and I have examined both horizontal and vertical sections, one of the former kindly prepared by Prof. Charles Stewart. A portion of a horizontal section is shown enlarged about 40 times in Pl. XV. fig. 7; and one of the Haversian systems from its middle area is represented, much more highly magnified, in fig. 7 *a*. The tissue is traversed in all directions by a dense mass of interlacing bundles of connective-tissue fibres, which exhibit an entirely irregular disposition, except quite at the periphery of the ossicle. Here they are less dense and are arranged in such a manner as to form at least one darkened zone concentric with the margin in the comparatively translucent border. Occasionally, but not at all points, the fibres in this peripheral area may be observed to radiate regularly outwards. Numerous small vascular canals, frequently branching, are cut in various directions; and the bony tissue, which is developed in every part of the ossicle, exhibits abundant

lacunæ. Nearly everywhere, except in the narrow peripheral area just mentioned, it is easy to recognize the bony laminæ arranged in Haversian systems round the canals; and most of the lacunæ between these laminæ are excessively elongated, with very numerous branching canaliculi, which extend at right angles to their longer axis. Near the margin of the ossicle, especially in its more translucent parts, the bone-lacunæ are less elongated, more irregular in shape, and apparently not arranged in any definite order (Pl. XV. fig. 7 *b*). There is no clear evidence of bony laminæ concentric with the outer margin, though appearances are sometimes suggestive of this arrangement. A vertical section of an ossicle presents exactly the same features as the horizontal section now described. It is thus evident that the vascular canals with their Haversian systems of bone have no definite direction, but are disposed in an entirely irregular manner.

Taking into consideration all characters, and making comparisons with the aid of my friend Mr. W. E. de Winton, I am inclined to regard the fragmentary specimen as the skin of the neck and shoulder-region with part of the left cheek. The apparent bilateral symmetry between at least part of the thickened anterior outer angles of the specimen has already been noted; and if this observation be well-founded, the middle line of the back extends vertically down the middle of the figure, Pl. XIII. If the rounded notch above B be the base of the external ear, as seems probable, the thick wrinkled skin (C) with fine short hair still further to the left must be the cheek. The ear and cheek on the right side have been removed; but at the base of the outwardly-turned angle on this side of the specimen there are the very long hairs which occupy a similar position on the left. It thus seems possible to estimate the transverse measurement between the ears as from 0·25 m. to 0·30 m., which corresponds with a tentative estimate of the same distance in *Mylodon robustus* based on a skull in the British Museum.

(b) *Comparisons and General Conclusions.*

The skin now described differs from that of all known terrestrial Mammalia, except certain Edentata, in the presence of a bony dermal armour. There can therefore be little doubt that the specimen has been rightly referred to a member of this typically South-American order. Even among the Edentates, however, the fragment now under consideration is unique in one respect; for all the ossicles are buried deeply in the lower half of the thickened dermis and the hairs are implanted in every part of its upper half, whereas all the forms of bony armour hitherto described in this order reach the outer surface of the dermis and are merely invested with horny epidermis. This is the case, as is well known, in the common existing Armadillos, in which the hair is only implanted in the dermis between the separate parts of the armour. Even in the unique and remarkable skin of an Armadillo from Northern Brazil, described by Milne-Edwards under the name of

Scleropleura bruneti[1], the bony plates and tubercles are still covered only by epidermis, although most of them are reduced to small nodules and might well have sunk more deeply into the abnormally hairy skin. There is also reason to believe that in the gigantic extinct Armadillos of the family Glyptodontidæ the same arrangement of dermal structures prevailed; for one specimen of *Panochthus tuberculatus* obtained by Dr. Moreno for the La Plata Museum actually shows the dried horny epidermis in direct contact with the underlying bone, and seems to prove that the numerous perforations in the Glyptodont dermal armour were not for the implantation of hairs (as once supposed), but for the passage of blood-vessels to the base of the epidermal layer. Similarly, among the extinct Ground-Sloths of the family Mylodontidæ dermal ossicles have been found with the remains of *Cœlodon*[2] and various forms (perhaps different subgenera) of *Mylodon*; but the only examples of this armour yet definitely described[3] exhibit a conspicuously sculptured outer flattened face, and it thus seems clear that Burmeister was correct in describing them as originally reaching the upper surface of the dermis and only covered externally by a thickened epidermis. Three such dermal tubercles, now in the British Museum, are shown of the natural size in Pl. XV. figs. 4–6. It is, however, to be noted that Burmeister himself actually observed armour of this kind covering only the lumbar region of the trunk. He believed that the other parts of the animal were similarly armoured, because he had found "the same ossicles" on the digits of the manus, where they were "generally smaller and more spherical"; but he unfortunately omits to make any explicit statement as to the presence or absence of the characteristic external ornamentation on the latter.

The omission just mentioned is especially unfortunate because on careful comparison it is evident that the irregular disposition of the small ossicles in the piece of skin now under consideration is most closely paralleled in the dermal armour of the extinct *Mylodon*, as already observed by Drs. Moreno and Ameghino. There is obviously no approach in this specimen to the definite and symmetrical arrangement of the armour such as is exhibited both by the existing Armadillos and the extinct Glyptodonts. There are, then, two possibilities. Either the dermal armour of *Mylodon* varied in different parts of the body, being sculptured and covered only by epidermis in the lumbar region, while less developed, not sculptured but completely buried in the dermis in the comparatively flexible neck and shoulder region—in which case Dr. Moreno may be correct in referring the problematical specimen to *Mylodon*; or the dermal ossicles of

[1] A. Milne-Edwards, "Note sur une nouvelle Espèce de Tatou à cuirasse incomplète (*Scleropleura bruneti*)," Nouv. Arch. Mus. vol. vii. (1871), pp. 177–179, pl. xii.

[2] P. W. Lund, K. Dansk. Vidensk. Selsk. Afhandl. vol. viii. (1841), p. 85 (footnote).

[3] H. Burmeister, Anales Mus. Publico Buenos Aires, vol. i. (1864–69), p. 173, pl. v. fig. 8.

this extinct genus may have been uniform throughout, only differing in size and sparseness or compactness—in which case Dr. Ameghino is justified in proposing to recognize a distinct genus, *Neomylodon*.

To decide between these two possibilities, it is necessary to wait for additional information concerning the anterior dorsal armour of *Mylodon* as precise as that published by Burmeister in reference to the lumbar shield. Meanwhile it must suffice to compare the microscopical structure of the ossicles from the new skin with that of the small sculptured tubercles of undoubted *Mylodon* represented in Pl. XV. figs. 4–6. Part of a horizontal section of one of these fossil ossicles is shown enlarged about 40 times in Pl. XV. fig. 8. It must be remembered that the specimen has been buried in the Pampa Formation for a long period, and that the oxides of iron and manganese have infiltrated the margin of the bone, rendering the structure of its outer border more conspicuous than that of its central portion. It must also be noted that some of the manganese has assumed its familiar "dendritic" aspect, in this respect presenting appearances not due to original structure. The calcified interlacing fibres of connective tissue are as abundant here as in the ossicle of the so-called *Neomylodon*; but in a very wide peripheral area they exhibit a marked radial disposition, nearly everywhere extending in bundles at right angles to the border. Rather large vascular canals, infiltrated with the oxides of iron and manganese, are observed in places, often bifurcated and usually bordered by a transparent zone free from the connective-tissue fibres. Well-developed bone-lacunæ are very abundant, many exhibiting short branching canaliculi (Pl. XV. fig. 8 *a*), and most of the others very irregular in shape, evidently furnished with canaliculi which cannot be seen from lack of infiltration. The lacunæ are never much elongated, and are not arranged in distinctly differentiated Haversian systems in any part of the section; while the only regular disposition of the bony laminæ is traceable near the circumference, where the lacunæ are frequently arranged or clustered in parallel zones concentric with the border. A vertical section of one of the same specimens shows the connective-tissue fibres radiating outwards towards the lateral margins, but not directly towards the upper sculptured face. There are no bony laminæ clearly parallel with the latter face, and at least one vascular canal in transverse section seems to be the centre of a Haversian system.

The histological structure of the ossicles in the skin now under consideration thus resembles that of the sculptured tubercles of *Mylodon* in all essential features, but differs in two noteworthy respects. In the ossicles of the so-called *Neomylodon*, as already described, the fibres of connective tissue do not exhibit much definite radiation towards the lateral margin; while the bony tissue at most points is disposed in definite Haversian systems. There is thus enough discrepancy to justify the suspicion that the new and the old specimens do not belong to the same animal.

In fact, so far as the differentiation of the dermal bone is concerned the so-called *Neomylodon* is precisely intermediate between *Mylodon* and the existing Armadillo (*Dasypus*); sections of the scutes of the latter animal, both in the Royal College of Surgeons and in the British Museum, showing that in this genus nearly the whole of the osseous tissue is arranged in Haversian systems, although abundant interlacing connective-tissue fibres are still entangled in it, at least near the border.

If the characteristic dermal armature does not suffice for the definite expression of an opinion as to the precise affinities of the specimen, a still less satisfactory result can be expected from a comparison of the hair. For, in the first place, no hair has hitherto been discovered in association with the skeleton of any extinct Ground-Sloth; while, secondly, the hairy covering of a mammal is perhaps that part of its organization most readily adapted to the immediate circumstances of its life. So far as their endoskeleton is concerned, the extinct Mylodonts and their allies are precisely intermediate between the existing Sloths and Anteaters; they combine "the head and dentition of the former with the structure of the vertebral column, limbs, and tail of the latter"[1]. It might therefore be supposed that the hair of this extinct group would exhibit some of the peculiarities of that in one or other of its nearest surviving relatives. The epidermal covering of the piece of skin now described, however, entirely lacks the under-fur which is so thick in the Sloths; while the structure of each individual hair, with its smooth cuticle and lack of a medulla, is strikingly different from that observed both in the Sloths and Anteaters, and identical with that of the hair in the surviving Armadillos. The large hair in the Sloths and *Tamandua* exhibits a conspicuously scaly cuticle; while that of *Myrmecophaga* is remarkable for its very large medulla. All these animals now live in the tropics, either in forests or swamps, whereas the Patagonian animal must have existed under circumstances much like those under which the Armadillos still survive. Hence the characters of the hair of the so-called *Neomylodon* may be of no great importance in determining the affinities of the animal, but may represent a special adaptation to its immediate environment.

Finally, there is the question of the antiquity of the problematical skin. On two occasions I have examined the mummified remains of the extinct Mammoth and Rhinoceros from Siberia in the Imperial Academy of Sciences at St. Petersburg; I have also carefully studied the remains of the neck and legs of the Moa from a cavern in New Zealand, now in the British Museum. Compared with these shrivelled and dried specimens, the piece of skin from Patagonia has a remarkably fresh and modern aspect; and I should unhesitatingly express the opinion that it belonged to an animal killed shortly before Dr. Moreno recognized its interest, had he not been able to give so circumstantial an account of its discovery and strengthened his point of view by recording the

[1] Flower and Lydekker, 'Introduction to the Study of Mammals,' p. 183.

occurrence of a human mummy of an extinct race in another cavern in the same district. The presence of an abundant covering of dried serum on one cut border of the skin is alone suggestive of grave doubts as to the antiquity of the specimen; but Dr. Vaughan Harley tells me that similar dried serum has been observed several times among the remains of the Egyptian mummies, and there seems thus to be no limit to the length of time for which it can be preserved, provided it is removed from all contact with moisture. I may add that I have searched in vain in the writings of Ramon Lista (so far as they are represented in the Library of the Royal Geographical Society) for some reference to the statement which the late traveller made verbally to Dr. Ameghino; and as the piece of skin now described certainly represents an animal almost gigantic in size compared with the Old-World Pangolin, I fear it cannot be claimed to belong to Lista's problematical quadruped, whatever that may prove to be.

The final result of these brief considerations is therefore rather disappointing. There are difficulties in either of the two possible hypotheses. We have a piece of skin quite large enough to have belonged to the extinct *Mylodon*; but unfortunately it cannot be directly compared with the dermal armour of that genus, because it seems to belong to the neck-region, while the only dermal tubercles of a Mylodont hitherto definitely made known are referable to the lumbar region. If it does belong to *Mylodon*, as Dr. Moreno maintains, it implies either that this genus survived in Patagonia to a comparatively recent date, or that the circumstances of preservation were unique in the cavern where the specimen was discovered. On the other hand, if it belongs to a distinct and existing genus, as Dr. Ameghino maintains—and as most of the characters of the specimen itself would at first sight suggest—it is indeed strange that so large and remarkable a quadruped should have hitherto escaped detection in a country which has been so frequently visited by scientific explorers.

[P.S.—At the reading of this paper Prof. Ray Lankester remarked that he should regard the characters of the hair as specially important, and would not be surprised if the problematical piece of skin proved to belong to an unknown type of Armadillo. This possibility had occurred to me, but I had hesitated to mention it on account of the considerable discrepancy observable between the arrangement of the bony armour in *Neomylodon* and that in the known Glyptodonts and the unique Brazilian Armadillo (*Scleropleura*), which happen to exhibit an incompletely developed (incipient or vestigial) shield. In each of the latter cases, the armour is not subdivided into a compact mass of irregular ossicles, but consists of well-separated elements which could only become continuous by the addition of a considerable extent of bone round their margins, or by the special development of smaller intervening ossicles.

Since the paper was read, I have had the privilege of studying Dr. Einar Lönnberg's valuable description of the pieces of the

problematical skin mentioned by Dr. Moreno as having been taken to Upsala by Dr. Otto Nordenskjöld[1]. It appears that with the skin was found the epidermal sheath of a large unknown claw, which may have belonged to the same animal. This specimen proves to be different from that of any existing Sloth, Anteater, or Armadillo, and is considered by Dr. Lönnberg to belong probably to the hind foot of a Mylodont, which did not walk on the exterior, lateral surfaces of the toes to the same extent as *Mylodon*. In a section of the skin provisionally ascribed to the leg, he observes that the small ossicles are very irregular, and shows two instances in which two are placed one above the other. In microscopical sections of the ossicles, however, he does not find the distinct Haversian systems of bone so conspicuous in my slides; and hence he fails to remark the differences between the structure of the armour in *Neomylodon* and *Mylodon*, which seem to me to be particularly noteworthy. His so-called "pigment cellules" in *Mylodon* are the dendritic infiltrations of oxide of manganese and stains of oxide of iron, to which I have made special reference. His observations as to the absence of a medulla in the hair confirm my own; but I have not seen any evidence of the suspected loss or disintegration of the hair-cuticle. Finally, Dr. Lönnberg has boiled a piece of the skin, thereby extracting glue, "which proves that the collagen and gelatinous substances are perfectly preserved." The latter observation confirms the evidence of the serum recorded above, and indicates that if the specimen is "of any considerable age, it must have been very well protected against moisture and bacteria."—A. S. W.]

EXPLANATION OF THE PLATES.

Plate XIII.

Neomylodon listai, Ameghino; outer aspect of piece of skin, one half nat. size.

Plate XIV.

Ditto; inner aspect of same specimen, one half nat. size.

Plate XV.

Fig. 1. *Neomylodon listai*, Ameghino; transverse section of skin, nat. size, showing hair above and ossicles in lower layer.
2, 3. Ditto; outer face of two ossicles, nat. size.
4–6. *Mylodon*, sp.; outer face of three ossicles, nat. size, one composed of two parts fused together. 4 *a*, 4 *b*. Inner and lateral aspect respectively of the specimen shown in fig. 4.
7. *Neomylodon listai*, Ameghino; portion of horizontal section of ossicle, about ×40. 7 *a*, 7 *b*. Haversian system and two marginal bone-lacunæ from the same, respectively ×85 and ×200.
8. *Mylodon*, sp.; portion of horizontal section of ossicle, about ×40. 8 *a*. Three bone-lacunæ from the same, ×200.

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[1] E. Lönnberg, "On some Remains of '*Neomylodon listai*,' Ameghino, brought home by the Swedish Expedition to Tierra del Fuego, 1895–1897," Wissensch. Ergebn. schwedisch. Exped. Magellansländ. unter Leitung v. Otto Nordenskjöld, vol. ii. pp. 149–170, pls. xii.–xiv. (1899).

2. On the Formation of the Coral-reefs on the N.W. Coast of Australia. By P. W. Bassett-Smith, R.N., F.Z.S.

[Received December 15, 1898.]

Mr. J. Stanley Gardiner has, in his most interesting paper read before the International Zoological Congress at Cambridge last August, again brought the question of the formation of Coral-reefs prominently before the scientific world. The character of the reefs at depths at which corals do not as a rule grow luxuriantly is of prime importance, and as every information of this nature, at first hand from a practical collector and naturalist, is of value if placed on record, I have been induced to bring to light some rather old work done in H.M.S. 'Penguin' on the North-west coast of Australia. All the specimens were at the time sent to the British Museum, being presented by the Admiralty; and, as I have not seen them since, I am not able to give specific or definite names to the specimens, which at the time of collecting it was impossible to do.

The part worked over consisted of the Holothuria Bank off the Admiralty Gulf, and the Baleine Bank off Roebuck Bay, together with some examinations of the fringing-reefs of the various islands along the coast. The former is in lat. 13°–13° 30′ S., long. 125° 40′–126° 20′ E., and extends a distance of 60 miles, being at nearest 14 miles from the coast and 100 from the 100-fathom line. The Baleine Bank is in lat. 15° 40′ S., long. 121° 50′ E., and is about 10 miles long.

The whole area was particularly noticeable for the remarkable abundance of (1) Alcyonarians; (2) Echinoderms, particularly the most beautiful Asterophytons; (3) the great quantity of calcareous Polyzoa of comparatively massive branching character. This region is a great centre of the pearl-shell fishery.

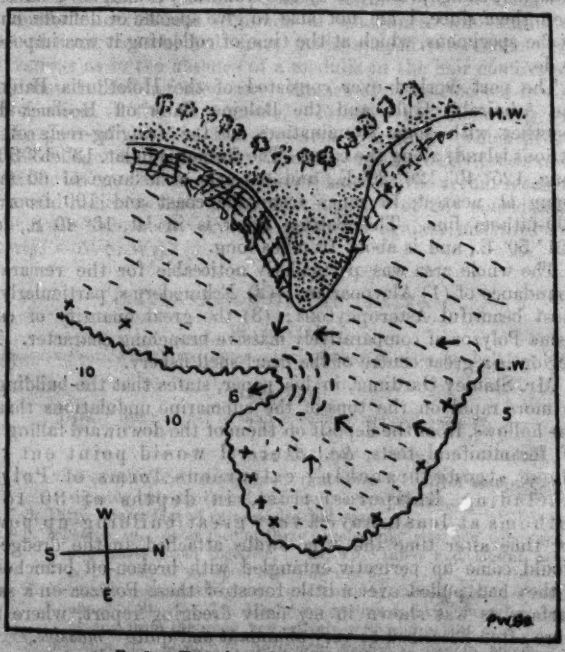
Mr. Stanley Gardiner, in his paper, states that the building-up is more rapid on the tops of the submarine undulations than in the hollows, from the deposit on them of the downward falling rain of foraminiferal tests, &c. Here I would point out that these strong branching calcareous forms of Polyzoa (including Retiporas) must, in depths of 30 to 60 fathoms at least, have a very great building-up power, for time after time the large swabs attached to the dredge-bag would come up perfectly entangled with broken-off branches, as if they had pulled over a little forest of these Polyzoa on a sandy surface, as was shown in my daily dredging report, where they were often described as very abundant and quite "*massive*."

In the more elevated portions of the Holothuria Bank, as on the Penguin reef, where there was only 15 fathoms, and on the Bassett-Smith shoal in 9–10 fathoms, the ordinary reef-corals were found (*Stylopora*, *Seriatopora*, *Astræa*, *Goniastræa*, *Plesiastræa*, *Phymastræa*, *Turbinaria*, *Montipora*, and *Porites*), though in shallow dredgings, 12–20 fathoms, on the Baleine Bank no corals at

all were obtained, either alive or dead, only great quantities of these low-branching Polyzoa. When we left the Australian coast for the Arafura Sea these general characters were absent.

Another peculiarity of this region was the great turbidity of the water near the coast and the large amount of slimy mud deposited on the flats, which as fringing-reefs were everywhere present, their seaward edge being marked by isolated, blackened, and elevated masses of coral-rock.

With such a considerable rise and fall of tide, 20 feet at springs, when walking on the reefs one was struck by seeing the large number of corals which were apparently able to stand a prolonged exposure to the blazing sun of this nearly equatorial latitude. Along with these tides there were strong and powerful currents, the average temperature of the water being 80°.



Reef on Troughton Island, N.W. Australia.

[← direction of current; soundings in fathoms. Tide-rise 20 feet.]

On the north end of Troughton Island, lat. 13° 40′ S., long. 126° 10′ E., the condition was as follows at nearly low-water springs:—The beach at high-water level was sand and shell, then

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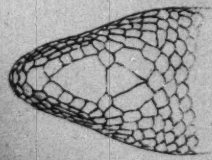

P.J.Smit del.et lith.

OPHISAURUS HARTI.

Mintern Bros. imp.

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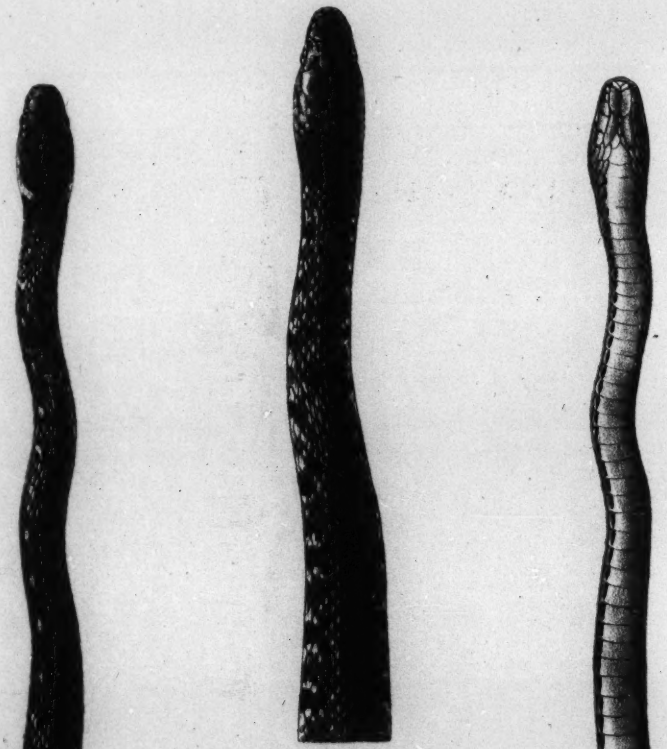

2.

1.

P.J.Smit del. et lith. 2. Mintern Bros. imp.

1.TROPIDONOTUS CRASPEDOGASTER. 2.T.PERCARINATUS.

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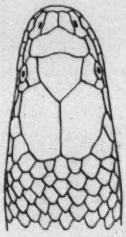

1a.

1c.

1b.

2a.

1.

2.

P.J.Smit del. et lith. Mintern Bros. imp.

1. TAPINOPHIS LATOUCHII. 2. TRIRHINOPHOLIS STYANI.

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2.

1.

3.

P.J.Smit del. et lith. Mintern Bros. imp.

1. RANA LATOUCHII. 2. RANA RICKETTI.
3. LEPTOBRACHIUM BOETTGERI.

coral conglomerate rocks running out to form the shore-platform, covered with mud and weed, about half a mile in extent, on it a few stunted Goniastræas, Mussas, Porites, and Madrepores, in pools. Here, too, were found numbers of black Holothurians, many Tridacnas, cones, volutes, large Aplysias, with small black Nemertines, Squillas, &c. This reef was much lower at the south side in a little bay where the water poured down in a series of rapids into the deep water, which here came close up to the reef; near to these rapids, and at the time exposed to the air and sun, I saw alive (1) great beds of Goniastræas of two kinds, one in small lobular masses, the other in large domes, the polyps of both being emerald-green; (2) very large branches of *Mussa recta*?, one specimen being 5 feet by 4 across; (3) *Cœloria* sp.; (4) *Prionastræa* sp., polyps also bright green; (5) *Symphyllia* sp., in domes; (6) *Porites* spp.; (7) *Meandrina* sp.; (8) *Tubipora* very plentiful; and (9) a few Fungias. On the margin and not exposed were great quantities of *Madrepora cytherea*, *M. speciosa*, and other pedunculate and dendroidal forms, *Millepora alcicornis*, *M. verrucosa*, *Heliopora cœrulea*, *Galaxea* spp. in large hemispherical masses, *Seriatopora* in very delicate but big bunches, *Merulina* sp., showing both delicate fan-like expansions and thick ramose prolongations, *Echinopora rosularia*, *Porites* spp., and *Pocillopora* spp.

3. On a Collection of Reptiles and Batrachians made by Mr. J. D. La Touche in N.W. Fokien, China. By G. A. Boulenger, F.R.S.

[Received February 1st, 1899.]

(Plates XVI.–XIX.)

An important collection of Reptiles and Batrachians was formed by Mr. J. D. La Touche during his stay, in the spring of 1896 and again in 1898, at Kuatun, a village about 270 miles from Foochow, in the mountains at the North-west of the Province of Fokien, at an altitude of 3000 to 4000 feet or more, and I have been entrusted by him with its description. Accounts of the Birds have been published by the collector and Mr. Ogilvie Grant and by the Rev. H. H. Slater in the 'Ibis'[1]; of the Mammals by Mr. Oldfield Thomas in these 'Proceedings'[2].

The interest of this collection resides not only in the number (8) of new species it reveals, and in the discovery of a Snake entitled to be made the type of a new genus, but also in the further demonstration of the close affinity which the fauna of the hills of the interior of China bears to that of the Himalayan-Burmese mountains—a fact which I have already had frequent opportunities of emphasizing by uniting forms described from

[1] Ibis, 1896, p. 489, and 1897, p. 169.
[2] P. Z. S. 1898, p. 769.

either region as distinct. On this point I cannot do better than recall the prefatory remarks of Mr. H. H. Slater in dealing with the Birds, viz.: "that many of the Himalayan birds, hitherto known only from the Indian side, would on further investigation be found, either in identical forms or as closely-allied representative species, in China . . . . . many of the birds [from Kuatun] are of genera well known in the Indian hill-country. Now, if N.W. Fohkien were anywhere near the Indian boundary the circumstance would be of interest; far more so when, in the present case, these birds come from a region much nearer to the Pacific coast." This is a confirmation of the view propounded by Mr. H. J. Elwes in his paper "On the Geographical Distribution of Asiatic Birds"[1], wherein the Himalo-Burmese and Chinese Avifaunas are shown to be one, and the limits of a "Himalo-Chinese" subregion are defined.

REPTILIA.

Lacertilia.

1. Gecko subpalmatus Gthr.

A single female specimen.

2. Acanthosaura lamnidentata Blgr.

Two male specimens.

The diameter of the orbit being 8 millim. in both specimens, the supraciliary spine measures 2, the supratemporal 3 and $2\frac{1}{2}$, the longest nuchal 3 (see measurements in Ann. Mus. Genov. [2] xiii. 1893, p. 317).

The discovery of this species in China is highly interesting; it was known only from Pegu, Tenasserim, and the Karin hills.

3. Ophisaurus harti, sp. n. (Plate XVI.)

Lateral teeth conical, curved, pointing backwards, finely striated, with a very feeble groove on the anterior side; a series of minute teeth on the pterygoids. Azygos præfrontal narrower than the greatest width of the frontal, in contact with or narrowly separated from the latter shield by one pair of præfrontals; interparietal broader than the parietals, much broader than the occipital, which is small; two azygos shields between the rostral and the azygos præfrontal; five supraoculars. Ear-opening minute, smaller than the nostril. Dorsal scales in 16 longitudinal and 103 to 106 transverse series; 8 or 10 dorsal series obtusely keeled; lateral and ventral scales smooth, the latter in 10 longitudinal series. No rudiments of limbs externally. Adult pale olive above, with irregular transverse series of blue spots; head dotted with blackish; lower parts white. Young white above, with an interrupted black vertebral line, deep black on the sides and below.

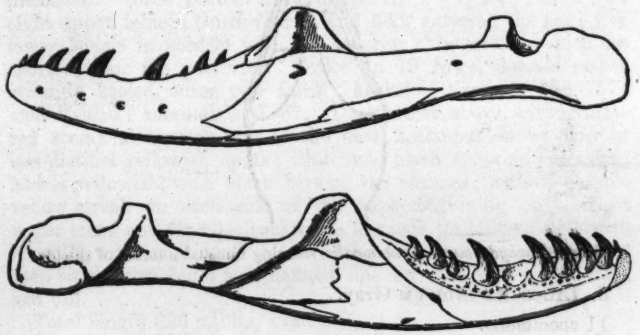
[1] P. Z. S. 1873 p. 615.

From snout to vent 270 millim.; tail (reproduced) 240.

Four specimens.

I have been requested by Mr. La Touche to dedicate this species as a compliment to his chief, Sir Robert Hart, Inspector of Chinese Customs.

Fig. 1.



Lower jaw of *Ophisaurus harti*, much enlarged.

In its dentition this species may be regarded as intermediate between *Anguis fragilis* and *Ophisaurus gracilis*. It differs from the latter in the presence of two scales between the rostral and the anterior præfrontal, instead of three, the still smaller ear-opening, and the greater number of longitudinal series of dorsal scales. The coloration is highly suggestive of affinity to our European Slow-worm, the teeth of which have been shown by Leydig to be slightly furrowed. There is absolute identity, in shape and number, between the head-shields of this species and those of *Anguis fragilis*.

4. TACHYDROMUS SEPTENTRIONALIS Gthr.

16 specimens.

I now agree with Dr. Günther as to the advisability of separating *T. septentrionalis* from *T. tachydromoides*, Schleg. (*cf.* Günther, Ann. & Mag. N. H. [6] i. 1888, p. 166).

All the specimens have a single inguinal pore, the number of these pores being variable in *T. sexlineatus*, 4 specimens out of 7 from Great Natuna Id. having a single pore instead of two (*cf.* Günther, Nov. Zool. ii. 1895, p. 499). The number of chin-shields is three, although there are occasional exceptions, *not* due to fusion or accidental division, as shown by the figure (p. 162) taken from one of the Kuatun specimens. The dorsal scales sometimes form 5 series instead of 6, and in one specimen they are even in 4 series on the posterior part of the back. Two of the specimens have the additional series of small scales between the outer pair of

large ones, as observed by Dr. Günther in two from Shanghai, the scales being practically in 8 series.

Fig. 2.

Chin of *Tachydromus septentrionalis*, showing unusual number of shields.

5. Lygosoma indicum Gray.

11 specimens.
34 or 36 scales round the middle of the body.

6. Lygosoma laterale Say (reevesii Gray).

A single specimen, with 26 scales round the middle of the body.

7. Eumeces elegans Blgr.

Numerous specimens.
The characters on which this species has been founded appear to be perfectly constant. Adult males have the sides of the head and neck of a bright vermilion, which colour is continued on the side of the body as more or less distinctly defined stripes above and below the light streak extending from the ear. The largest specimen measures 93 millim. from snout to vent.

Ophidia.

8. Polyodontophis collaris Gray.

Two specimens.
These specimens agree with the one from Ichang described by Günther as *Ablabes chinensis* (Ann. & Mag. N. H. [6] iv. 1889, p. 220) in having the eighth upper labial excluded from the labial margin, thus constituting a lower anterior temporal—a character which I have found to be inconstant in *Polyodontophis subpunctatus* and *P. bistrigatus*, and which I expect would likewise break down if a larger number of Chinese specimens could be examined.
The larger specimen has 184 ventrals and the tail is imperfect; the other has 178 ventrals and 110 subcaudals.

9. Tropidonotus craspedogaster, sp. n. (Plate XVII. fig. 1.)

Eye rather large. Rostral once and two thirds as broad as deep, scarcely visible from above; nasal completely divided; internasals shorter than the præfrontals; frontal once and two thirds as long as broad, longer than its distance from the end of the snout, shorter than the parietals; loreal as long as deep; one præocular; three postoculars; temporals 1+1, 2+1, or 2+2; eight upper labials, third, fourth, and fifth entering the eye; five lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales in 19 rows, dorsals rather strongly keeled, outer row faintly keeled. Ventrals 145–157; anal divided; subcaudals 87–97. Dark brown above, with a rusty-red streak along each side of the back, accompanied by more or less distinct yellowish spots; ill-defined black spots on the sides; labials yellowish, with black bars on the sutures; a short oblique yellow streak on each side of the nape, beginning on the last upper labial and directed backwards towards its fellow; yellowish beneath, with an elongate black spot near the outer extremity of each shield, forming a well-defined line on each side of the belly and tail.

Total length 635 millim.; tail 185.

Six specimens.

Closely allied to *T. khasiensis* Blgr. Differing in the larger eye, the keeled outer row of scales, and the coloration.

10. Tropidonotus piscator Schn.

A single specimen.

11. Tropidonotus percarinatus, sp. n. (Plate XVII. fig. 2.)

Eye moderate. Rostral twice as broad as deep, just visible from above; nasal completely divided; internasals much longer than broad, much narrowed anteriorly, longer than the præfrontals; frontal once and three fifths as long as broad, as long as its distance from the end of the snout, a little shorter than the parietals; loreal as long as deep; one præocular; three postoculars+one very small subocular; temporals 2+3; eight upper labials, fourth and fifth entering the eye; five lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales in 19 rows, all keeled, dorsals very strongly. Ventrals 141; anal divided; subcaudals 71. Greyish olive above, sides with light-edged black vertical bars; the four anterior upper labials greyish olive like the upper surface of the head, the rest uniform yellowish white like the lower surface; belly uniform yellowish white anteriorly, spotted and speckled with blackish posteriorly; lower surface of tail dark grey, with some black spots.

Total length 500 millim.; tail 130.

A single male specimen.

Very closely allied to *T. annularis* Hallow. Distinguished by

the larger eye, the broader rostral, the shorter parietals, the presence of three postoculars instead of two, and the coloration of the upper labials.

12. TROPIDONOTUS TIGRINUS Boie.

A single specimen.

TAPINOPHIS, g. n.

Teeth small, equal, 17 or 18 in the maxillary. Head small, much depressed, not distinct from neck; eye very small, with round pupil; nostril in the upper part of an undivided nasal; præfrontal single; no præocular; loreal entering the eye. Body cylindrical; scales feebly keeled, without apical pits, in 17 rows; ventrals rounded. Tail rather short; subcaudals in two rows. Hypapophyses developed throughout the vertebral column.

This genus is nearest allied to *Opisthotropis* Gthr.

13. TAPINOPHIS LATOUCHII, sp. n. (Plate XVIII. figs. 1–1 *c*.)

Rostral broader than deep, with straight transverse upper border, just visible from above; nasals rather large, separated by a pair of narrow internasals; præfrontal twice and a half as broad as long; frontal as long as broad, as long as its distance from the end of the snout, shorter than the parietals; supraocular narrow; loreal twice as long as deep; two postoculars, lower smaller; temporals 1+1 or 2; nine upper labials, the first three in contact with the nasal, fifth and sixth entering the eye; four lower labials in contact with the anterior chin-shields, which are longer than the posterior; the latter separated from each other by one scale. Scales in 17 rows, the feeble keel not extending to the extremity of the scale. Ventrals 149; anal divided; subcaudals 53. Olive above, with interrupted black longitudinal lines, yellow on the sides and below; a black streak along the side of the body, along the adjacent halves of the second and third rows of scales; labials edged with blackish; lower parts uniform, except the base of the tail, which bears a black median streak.

Total length 455 millim.; tail 85.

A single female specimen.

14. TRIBHINOPHOLIS STYANI, sp. n. (Plate XVIII. figs. 2 & 2 *a*.)

Snout short, slightly prominent. Rostral rather large, once and two thirds as broad as deep, the portion visible from above about half as long as its distance from the frontal; internasals twice as broad as long, much shorter than the præfrontals; frontal hexagonal, once and one third or once and a half as long as broad, longer than its distance from the end of the snout, a little shorter than the parietals; no loreal, posterior nasal forming a suture with the single præocular; two postoculars; temporals 2+2; six or seven upper labials, third and fourth entering the eye; anterior chin-shields longer than the posterior, in contact with the symphysial and three lower labials. Scales in 15 rows. Ventrals

112–121; anal entire; subcaudals 22–28. Brown above, with very small black spots; a black nuchal blotch or cross-band edged with yellowish; labials yellowish, with blackish edges; rostral yellowish, with a large blackish spot; ventrals and subcaudals yellowish, dotted and speckled with blackish on the sides.

Total length 350 millim.; tail 45.

Two specimens, male (V. 112; C. 28) and young (V. 121; C. 22).

Named after Mr. F. W. Styan, whose collections have so much advanced our knowledge of the fauna of China.

The discovery of this species lessens the gap between the genera *Plagiopholis* and *Trirhinopholis*, both established on single species from the Shan States.

15. Dinodon septentrionalis Gthr.

Three specimens.

Intermediate in the pattern of coloration between the typical form from Assam and Burma and the var. *ruhstrati* Fischer from Formosa. The pale interspaces between the dark brown dorsal spots are very narrow throughout and nowhere form complete annuli.

16. Coluber porphyraceus Cantor.

Four specimens.

Two black lines extend from the eyes to the end of the tail, intersecting the dark cross-bars, which have a tendency to disappear in adult specimens.

This species had not been recorded from farther north-east than Yunnan.

17. Coluber mandarinus Cantor.

Two specimens.

Temporals 2+2 or 3; one of the specimens has a single postocular, the lower having fused with the fourth labial.

This most beautifully-marked Snake was known only from Chusan.

18. Coluber phyllophis Blgr.

Two specimens.

19. Ablabes major Gthr.

Three specimens.

A young specimen has irregular black transverse spots on the nape and anterior part of the back, and traces of an interrupted black lateral streak.

20. Calamaria septentrionalis Blgr.

A single specimen (♀. V. 174; C. 8).

21. Bungarus candidus L.

A single specimen, pertaining to the var. *multicinctus* Blyth.

22. CALLOPHIS MACCLELLANDII Reinh.

A single specimen, measuring 660 millim., of the typical form (♂. V. 193; C. 36).

23. ANCISTRODON ACUTUS Gthr.

Two male specimens (V. 164, 161; C. 56, 59).

This large pit-viper, discovered by Mr. A. E. Pratt in the mountains north of Kiukiang and since obtained at Ichang by the same traveller, is, I am informed by Mr. Styan, of gentle disposition and is freely handled by the Chinese.

24. LACHESIS GRAMINEUS Shaw.

A single specimen.

BATRACHIA.

1. RANA KUHLI D. & B.

Numerous specimens of a small form—the largest male measuring 60 millim. from vent to snout, the largest female full of ripe eggs 51—distinguished by a rather shorter web between the toes, the membrane reaching only the penultimate phalanx of the fourth toe. The first finger does not extend, or extends but very slightly, beyond the second. Males have a very large head and are devoid of a vocal sac and of nuptial horny excrescences. A Chinese specimen, from the Lofau hills, Province of Canton, has been described by Peters in 1882 under the name of *Nyctibatrachus sinensis*.

Specimens obtained by Dr. J. Anderson in Yunnan, and now preserved in the British Museum, are intermediate between the Kuatun specimens and the typical form from Java in the extent of the web on the sides of the fourth toe. 7 out of the 19 Kuatun specimens have a yellow vertebral stripe.

2. RANA BOULENGERI Gthr.

This species is very closely allied to *R. kuhlii*, with which I have confounded it in the British Museum 'Catalogue.' The female, from Ningpo, has been described and figured by Günther in the 'Reptiles of British India,' p. 404, pl. xxvi. fig. A, as *R. kuhlii*, and the breeding male has been since described from two specimens from Ichang and kindly named after me (Ann. & Mag. N. H. [6] iv. 1889, p. 222). Young specimens from near Ningpo have been presented to the British Museum by Messrs. Bassett-Smith and J. J. Walker.

Two specimens, male and female, are in Mr. La Touche's collection.

The following description is based on 7 specimens.

Vomerine teeth in two small oblique groups commencing on a level with, and extending back beyond, the choanæ. No tooth-like processes in the lower jaw. Head broader than long; snout short, broadly rounded, a little shorter than the diameter of the

orbit; canthus rostralis very obtuse; loreal region very oblique, slightly concave; nostril nearer the eye than the end of the snout; interorbital space a little narrower than the upper eyelid; tympanum hidden. Fingers rather short, feebly swollen at the tips, first extending considerably beyond second; subarticular tubercles moderately developed. Toes rather short, broadly webbed to the tips, which are dilated into small but very distinct disks; subarticular tubercles moderate, oval; inner metatarsal tubercle feebly prominent, elongate, measuring two thirds its distance from the tip of the inner toe; no outer metatarsal tubercle; a feeble dermal fold along the inner edge of the tarsus. The tibio-tarsal articulation reaches the eye; tibia about half length of head and body. Skin of upper parts granular or shagreened, with numerous warts, which may be small and subconical or large and elongate on the back; these warts may bear black horny spinules; a strong fold across the head, connecting the posterior borders of the upper eyelids; a very strong ridge from the eye to the shoulder; no glandular dorso-lateral fold; lower parts smooth. Dark olive or blackish brown above; lips with darker vertical bars; limbs with more or less distinct black cross-bars; hinder side of thighs black, with more or less distinct lighter marblings; lower parts whitish, throat and lower surface of limbs spotted or marbled with blackish. Male with small internal vocal sacs; during the breeding-season the fore limbs are more or less strongly thickened, and the breast and inner side of the three inner fingers armed with small black horny spines.

From snout to vent, ♂ 105 millim., ♀ 103.

This species is exactly intermediate between *R. kuhlii* and *R. liebigii*.

3. Rana japonica Blgr.

A single young specimen.

4. Rana latouchii, sp. n. (Plate XIX. fig. 1.)

Vomerine teeth in two oblique oval groups in the middle between the choanæ. Head as long as broad; snout as long as the diameter of the orbit, obtusely pointed, projecting beyond the mouth, with distinct canthus and feebly oblique, slightly concave lores; nostril nearer the end of the snout than the eye; interorbital space as broad as the upper eyelid; tympanum very distinct, three fifths or two thirds the diameter of the eye. Fingers slender, feebly swollen at the end, first extending beyond second; subarticular tubercles very strong. Toes slender, two-thirds webbed, with swollen tips and strong subarticular tubercles; inner metatarsal tubercle small, oval; a very prominent, round, outer metatarsal tubercle. Tibio-tarsal articulation reaches the anterior border of the eye; tibia half as long as head and body. Upper parts finely granular; a very prominent, very broad dorso-lateral glandular fold, almost deserving to be termed a parotoid, its width above the shoulder at least as great as that of the upper eyelid;

two strong glands behind the angle of the mouth. Greyish above, uniform or with small blackish spots; a black stripe below the canthus rostralis, over the tympanum, and along the outer edge of the dorso-lateral fold; upper lip white; flanks and hinder side of thighs pale, with black spots; limbs with regular dark cross-bars; lower parts white, uniform or with some greyish spots on the throat and breast. Male with small internal vocal sacs, without humeral glands, with a strong pad on the inner side of the first finger.

From snout to vent, ♂ 37 millim., ♀ 45.

Three specimens.

Nearly allied to *R. guentheri* Blgr., but distinguished by the broader dorso-lateral folds, the shorter hind limbs, and the much smaller size.

5. RANA ANDERSONI Blgr.

A large female specimen, measuring 87 millim. from snout to vent, agrees well with a similarly large example obtained by Signor Fea in the Kakhyen hills, Upper Burma. The types are from the Hotha valley, Yunnan (5000 feet).

Rana schmackeri Boettger (Kat. Batr. Senck. Ges. 1892, p. 11), from Ichang, appears to agree in every respect with *R. andersonii* except in the larger tympanum, measuring three fourths the size of the eye, whereas in the latter species its diameter does not exceed three fifths that of the eye.

6. RANA RICKETTI, sp. n. (Plate XIX. fig. 2.)

Vomerine teeth in two small groups close together behind the level of the choanæ. Head much depressed, as long as broad; snout shorter than the diameter of the orbit, rounded, projecting beyond the mouth; canthus rostralis distinct; loreal region nearly vertical, concave; nostril equidistant from the end of the snout and from the eye; interorbital space nearly as broad as the upper eyelid; tympanum distinct, small, one third or two fifths the diameter of the eye. Fingers short, depressed, terminating in large disks, which are quite as large as the tympanum; first finger much shorter than the second, third as long as the distance between the anterior border of the eye and the tympanum. Toes rather short, very broadly webbed to the disks, which are a little smaller than those of the fingers; subarticular tubercles rather small; a small, oval, inner metatarsal tubercle; no outer metatarsal tubercle. The tibio-tarsal articulation reaches the tip of the snout; tibia a little more than half the length of head and body. Skin finely shagreened above, with scattered small flat warts; a fold above the tympanum; no dorso-lateral fold; belly granular. Olive above, marbled with darker; a dark streak on each side of the head, passing through the eye; limbs with regular dark cross bands; whitish beneath.

From snout to vent 37 millim.

Two specimens.

This species, named after Mr. C. B. Rickett, is closely related to *R. latopalmata* Blgr. (*afghana* Gthr.), from which it is easily distinguished by the shorter fingers and the shorter hind limbs.

7. Rhacophorus leucomystax Gravh.

Although the largest specimen measures 50 millim. from snout to vent, the head is, as I have noticed before in Chinese specimens, devoid of dermal ossification. The back of the thighs is whitish, with a dark brown network.

I seize this opportunity to observe that the Moupin *Rhacophorus davidi* Sauv. is not closely allied to this species. I examined the types in the Paris Museum some years ago, and noted that the fingers are one-third or one-fourth webbed and the inner metatarsal tubercle is large, oval, somewhat more than half as long as its distance from the tip of the inner toe. *R. davidi* is intermediate between *R. microtympanum* and *R. schlegelii*.

8. Rhacophorus dennysii Blanf.

This fine Frog was described in 1881 from a specimen of doubtful origin, obtained alive from a Chinese merchant at Singapore and said to have originally come from China. The type specimen, presented by Dr. Dennys to the Raffles Museum, was found, in bad condition, among the unnamed specimens of that establishment a few years ago by Mr. S. S. Flower, who brought the specimen over to London. I have been able to compare it with a second specimen, from Foochow, presented to the British Museum by Mr. C. B. Rickett in 1894. Mr. La Touche's Kuatun collection contains three specimens. The following description is taken from the five specimens now before me, varying in size from 86 to 115 millim., measured from snout to vent, the species being one of the largest of the genus:—

Vomerine teeth on two strong, straight or slightly oblique transverse ridges touching the inner front edge of the choanæ and separated by an interspace less than the width of one of the ridges. Head much depressed, broader than long, though sometimes very slightly; snout rounded, truncate at the end and slanting from the nostrils to the edge of the mouth, its length equal to the diameter of the orbit; canthus rostralis strong; loreal region concave; nostril nearer the end of the snout than the eye; interorbital space broader than the upper eyelid; tympanum very distinct, measuring two thirds to three fourths the diameter of the eye. Fingers with very large disks, broadly webbed, the web reaching or nearly reaching the disks between the two outer, also reaching the disk on the outer side of the second finger, but only the penultimate phalanx on the inner side of the second and third; a large, compressed, crescentic tubercle (rudimentary pollex) at the base of the inner finger, which is much shorter, and has a much smaller distal expansion, than the second; the largest digital disks nearly equalling the tympanum in size. Toes moderately elongate, webbed to the disks, which are

smaller than those of the fingers; subarticular and inner metatarsal tubercles moderate, flat. The tibio-tarsal articulation reaches the eye; tibia not half length of head and body. Skin of upper parts more or less granular, the granules very feeble, though distinct, in the type specimen, most developed in one of the males from Kuatun; belly and lower surface of thighs coarsely granular; throat smooth or feebly granular; a dermal ridge above the tympanum; no folds along the limbs.

Mr. Blanford was informed by Dr. Dennys that the type specimen, a female, was of a beautiful emerald-green colour when alive. It was, in spirit, dark violet, almost slaty above, with a brown spot behind the occiput, dirty white below, mottled with dusky. It is now nearly completely bleached, traces of the violet colour being only discernible on the parts protected from the light by the folding of the limbs. The Foochow specimen, a female, is dark violet above, with four irregularly disposed rusty spots edged with whitish on the head and scapular region; a few similar spots on the fore limbs; a pale golden lumbar spot, and streaks of the same tint and edged with brown across the anal region and along the outer edges of the forearm and the hand and of the tarsus and foot; white beneath, the lower jaw broadly edged with violet. The three specimens from Kuatun, all males, with internal vocal sac, have retained a dark green coloration; one of them has the red spots on the head of the Foochow specimen; all three have a lateral series of irregular, white, black-edged spots, extending from the shoulder to the groin.

9. Bufo vulgaris Laur.

The examination of the 32 specimens brought home by Mr. La Touche (males up to 110 millim. from snout to vent, females up to 122) confirms the opinion I have previously expressed as to the impossibility of defining with anything like precision the Eastern form of our Common Toad even as a variety or subspecies. In some of the specimens the tympanum is almost hidden, in others it is very distinct and its diameter, as compared with that of the eye, varies between one half and three fourths. The toes are only half or barely two-thirds webbed, even in males with the nuptial excrescences, and the fourth toe is generally a little longer in proportion than in European specimens. A black lateral band is usually well marked, as in Japanese specimens, and the ventral marbling is usually very striking, although varying in extent and intensity. Some of the specimens have a yellow vertebral line, as well marked as in *Bufo calamita*.

In describing Chinese specimens under the name of *Bufo vulgaris japonicus*, in 1880, M. Lataste has pointed out a difference in the shape of the testis in the breeding male. This is described as being shaped like a long cylinder attenuate in front, its width 7 or 8 times in its length, and occupying the whole length of the abdominal cavity, whilst in the European specimens the organ is oval, elongate, depressed, its width usually twice and a half in its

length. The character is not borne out by the Kuatun males, two of which, measuring 110 and 83 millim. from snout to vent respectively, I have examined in this respect: the testes have a length of 12 and 11 millim., and a width of 4 and 3, the kidneys measuring 21 and 19 millim. The organ in question is therefore but slightly longer than usual in European specimens.

10. LEPTOBRACHIUM BOETTGERI, sp. n. (Plate XIX. fig. 3.)

Tongue entire. Vomerine teeth none. Head moderate, broader than long; snout very short, obliquely truncate, projecting beyond the mouth; canthus rostralis angular; loreal region concave; interorbital space as broad as the upper eyelid; tympanum very distinct, two thirds the diameter of the eye. Fingers slender, slightly swollen at the end, first and second equal. Toes slender, slightly swollen at the end, with a slight rudiment of web; a small, oval, flat inner metatarsal tubercle; no subarticular tubercles. The tibio-tarsal articulation reaches the eye. Skin smooth, with small scattered warts on the head and back; two small white warts close together on the chin and one on each side of the breast near the insertion of the fore limb. Dark grey or brown above, with symmetrical blackish markings; upper surface of snout and scapular regions light; a whitish blotch on the upper lip below the anterior half of the eye; limbs with dark cross bands; a small round white spot on the back of the thigh; throat and breast brown or brownish; three longitudinal, blackish, light-edged markings on the throat; large blackish spots on the sides of the belly; posterior part of belly and lower surface of thighs dirty white. Male with internal vocal sacs.

From snout to vent, ♂ 35 millim., ♀ 46.

Six specimens.

Closely allied to *L. monticola* Gthr.; differing in the entire tongue and the absence of vomerine teeth. Had I examined but a single specimen, I should not have ventured to separate it from *L. monticola*. That is my excuse, but I must, however, apologize to Prof. Boettger for having, a few years ago, identified a specimen from Kiukiang, which he submitted to me, as a young individual of that species (*cf.* Ber. Senckenb. Ges. 1894, p. 141). I wish to atone for my mistake by connecting with this new species the name of my distinguished colleague. *Ixalus lateralis* And., which I have placed in the synonymy of *Leptobrachium monticola*, regarding it as based on a young specimen, agrees with *L. sinensis* in the absence of vomerine teeth, but the tongue is described as slightly notched behind. That the presence or absence of vomerine teeth is a dangerous character to use, unaccompanied by others, in the distinction of species in this genus has been shown in the case of *L. carinense* Blgr. (*cf.* W. L. Sclater, P. Z. S. 1892, p. 347). The length of the hind limbs varies much in *L. monticola*. In Günther's type specimen from Sikkim they bear the same proportions as in *L. sinense*, the tibio-tarsal articulation reaching the eye.

EXPLANATON OF THE PLATES.

Plate XVI.

Ophisaurus harti, p. 160. Adult and young, and upper view of head.

Plate XVII.

Fig. 1. *Tropidonotus craspedogaster*, p. 163. Upper, lower, and side views of head and anterior part of body.
2. *Tropidonotus percarinatus*, p. 163. Upper and side views of head and anterior part of body.

Plate XVIII.

Fig. 1. *Tapinophis latouchii*, p. 164. Upper and side views of head and anterior part of body.
1 *a*. Ditto. Upper view of head, enlarged.
1 *b*. Ditto. Side view of head, enlarged.
1 *c*. Ditto. Lower view of head, enlarged.
2. *Trirhinopholis styani*, p. 164. Upper and side views of head and anterior part of body.
2 *a*. Ditto. Chin-shields.

Plate XIX.

Fig. 1. *Rana latouchii*, p. 167.
2. „ *ricketti*, p. 168.
3. *Leptobrachium boettgeri*, p. 171.

4. A Revision of the Moths of the Subfamily *Pyraustinæ* and Family *Pyralidæ*. By Sir G. F. Hampson, Bart., F.Z.S. &c.

Part II.[1]

[Received January 10, 1899.]

In the first part of this paper, the classification of the subfamily *Pyraustinæ* of the *Pyralidæ* was completed as far as the end of the 1st group of genera with upturned palpi; in the present part the second group of genera with porrect palpi is dealt with. The key to all the genera of the subfamily, the phylogenetic table, and the plates illustrating some of the new species were given in the first part of the paper.

We should be greatly obliged for the loan of specimens of any of the species mentioned in the series of papers on the *Pyralidæ* that I have been unable to identify; they would be carefully packed and returned after examination.

Genus 88. Megaphysa.

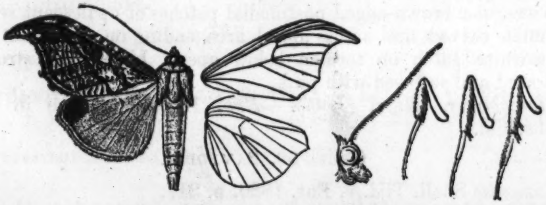
Megaphysa Guen. Delt. & Pyr. p. 213 (1854).

Palpi porrect, short, the 2nd joint very broadly fringed with scales below, the 3rd short, naked and downturned; maxillary palpi filiform; frons rounded; antennæ of male ciliated; tibiæ fringed with thick hair on inner side, hind tarsi with the 1st joint fringed with hair on outer side. Fore wing with the costa very

[1] Continued from P. Z. S. 1898, pp. 590–760.

much arched towards apex, which is produced and extremely falcate; the outer margin excurved below middle; veins 3, 4, 5 from angle of cell; 7 curved and approximated to 8, 9, to which 10 also is approximated. Hind wing with the cell rather short; veins 3, 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 88.



Megaphysa herbiferalis, ♂. ½.

Type. MEGAPHYSA HERBIFERALIS Guen. Delt. & Pyr. p. 213, pl. 5. f. 9. Colombia; Ecuador.

Genus 89. FURCIVENA.

Furcivena Hmpsn. Moths Ind. iv. p. 374 (1896).

Palpi porrect, the 2nd joint fringed with scales below, the 3rd naked; maxillary palpi filiform, frons flat and oblique; tibiæ with the outer spurs half the length of inner. Fore wing with vein 3 from angle of cell; 4, 5 stalked; 7 and 10 well separated from 8, 9. Hind wing with the cell about half the length of wing; vein 3 from angle; 4, 5 stalked; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 89.

Furcivena strigiferalis, ♂. ½. (From Moths Ind. vol. iv.)

SECT. I. Antennæ of male thickened and flattened.

Type. (1)†FURCIVENA STRIGIFERALIS Hampsn. Moths Ind. iv. p. 374. Sikhim.

SECT. II. Antennæ of male annulate.

(2)*FURCIVENA RHODONEURIALIS, n. sp.

♂. White tinged with yellowish. Fore wing with slight pink suffusion on disk; the cilia brown at middle and tornus. Hind wing whiter, with discoidal brown point; some pink suffusion in

and below cell and near the medial and postmedial brown lines, the former from below costa, excurved at median nervules and recurved at vein 1, the latter straight from costa to vein 5, then excurved to termen; an apical brown patch and line through the cilia. Underside of fore wing pale chestnut, with whitish patch below cell; irregular streaks and patches of black scales in and below cell and patches of opalescent scales on median nervure and in and beyond end of cell; some pink suffusion below end of cell; two irregular brown-edged postmedial patches of opalescent scales; a similar curved line across apical area ending on termen at vein 2; a white patch on termen below apex; hind wing strongly irrorated and suffused with pink.

Hab. Niger, Warri (*Roth*). *Exp.* 18 mm. Type in Coll. Rothschild.

Genus 90. Sameodes.

Sameodes Snell. Tijd. v. Ent. 1880, p. 217.
Pesocosma Meyr. Trans. Ent. Soc. 1884, p. 301.
Mimorista Warr. A. M. N. H. (6) vi. p. 476 (1890).

Palpi rostriform, extending about the length of head, the 3rd joint prominent and downcurved; maxillary palpi filiform; frons rounded. Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9. Hind wing with the costa slightly excised beyond middle; veins 4, 5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 90.

Sameodes cancellalis, ♂. ½. (From Moths Ind. vol. iv.)

Sect I. Antennæ of male with long cilia and sinuous at middle; both wings with the apex somewhat produced.

A. (*Sameodes*). Male with a swelling on outer side of mid tibia before the medial spurs, of which the outer is minute, the terminal spurs replaced by a small tuft of scales; the tibia bent beyond middle. Fore wing with a large medial costal lobe on upperside; hind wing with the costa excised before the middle as well as after.

Type. (1) Sameodes cancellalis Zell. Lep. Caffr. p. 34. Africa; India, Ceylon, & Burma; Java; Australia.

†*Stenia pipleisalis* Wlk. xvii. 420; Moore, Lep. Ceyl. iii. pl. 181. f. 14.

†*Lepyrodes lepidalis* Wlk. xvii. 465.

†*Samea sidealis* Wlk. xix. 937.
†*Hymenia meridionalis* Wlk. xxxiv. 1314.
Sameodes trithyralis Snell. Tijd. v. Ent. 1880, p. 218, & 1883, pl. 8. f. 4.
Samea vespertinalis Saalm. Ber. Senck. Ges. 1880, p. 301.

B. (*Pessocosma*). Male with the hind tibiæ not distorted, the outer spurs half the length of inner; fore wing with no costal lobe.

(2)†SAMEODES PERITALIS Wlk. xvii. 466; Hmpsn. Ill. Het. ix. pl. 174. f. 21. India; Ceylon.

(3)†SAMEODES BISTIGMALIS Pryer, Cist. Ent. ii. p. 234, pl. 4. f. 10 (♀). N. China.

(4)†SAMEODES IOLEALIS Wlk. xvii. 466. Australia.

SECT. II. (*Mimorista*). Antennæ of male normal and minutely ciliated.

A. Hind wing of male with the cell very short, its upper part filled by a large hyaline fovea.

(5) SAMEODES MILTOCHRISTALIS Hmpsn. Moths Ind. iv. p. 375. N.E. India; Burma.

B. Hind wing of male normal.

a. Fore wing with tooth of scales on inner margin before middle.

(6)†SAMEODES NOTODONTALIS, n. sp.

♀. Head and thorax yellow and fiery orange; abdomen ochreous. Fore wing suffused with fiery orange, leaving subbasal, antemedial, and medial series of ill-defined yellow spots; an oblique medial pinkish band expanding towards costa; the terminal area pinkish, its inner edge with darker points and obtusely angled at vein 5. Hind wing semihyaline yellow, tinged with fuscous towards termen.
Hab. Sandakan, Borneo (*Pryer*). *Exp.* 20 mm.

b. Fore wing without scale-tooth on inner margin.

(7)†SAMEODES OLESIALIS Wlk. xviii. 748 (♀). W. Africa.

(8) SAMEODES BOTYDALIS Guen. Delt. & Pyr. p. 197. W. States, C. & S. Amer.
Botys acutalis Snell. Tijd. v. Ent. 1875, p. 200, pl. 11. f. 10.

(9)†SAMEODES SANGUIMARGINALIS, n. sp. (1898, Plate L. fig. 27.)

♀. Head, thorax, and abdomen pink. Fore wing hyaline yellow; the base and costal area pink, the latter emitting a small tooth in cell and a triangular patch on discocellulars; a large quadrate pink apical patch extending down to vein 5, with traces

of an oblique dentate postmedial fuscous line from its lower edge and yellowish terminal patches on it in the interspaces; a fine terminal pink line running a short way inwards on inner margin. Hind wing hyaline yellow, with fuscous discal point and very indistinct dentate postmedial line bent outwards between veins 5 and 2; a terminal pink line expanding slightly at apex and at vein 2.

Hab. Colombia, Bogota. *Exp.* 40 mm.

(10)†Sameodes suffusalis, n. sp.

♂. Pale red-brown. Fore wing with dark-edged hyaline specks at and below middle of cell and larger spots in and below end of cell; a hyaline postmedial band from subcostals to vein 2, then curving round to lower angle of cell, edged on inner side by a black line and traversed by a minutely crenulate black line. Hind wing semihyaline white, with black-edged fulvous spots in and below middle of cell and larger spot in end of cell; a postmedial waved black line bent outwards between veins 5 and 2; a fulvous marginal band, wide at apex, narrowing to anal angle.

Hab. Pernambuco; Argentina. *Exp.* 22 mm.

(11)†Sameodes enderythralis, n. sp.

♂. Dull brown; abdomen reddish on dorsum; palpi at base, pectus, and ventral surface of abdomen white. Fore wing with the basal area below the cell orange, with patches of red scales; traces of antemedial and medial lines on inner area; a hyaline discal point; a postmedial orange wedge-shaped patch from costa to vein 5, traversed by the postmedial line, which is obtusely angled at vein 6. Hind wing with the basal half orange, with diffused sinuous subbasal and antemedial bands; the terminal half brown with some red on its inner edge.

Hab. Sikhim (*Pilcher*). *Exp.* 15 mm.

(12) Sameodes pictalis Swinh. A. M. N. H. (6) xvi. p. 303. Assam.

(13) Sameodes monostictalis, n. sp.

Orange; legs white. Fore wing with indistinct sinuous fulvous antemedial line; a large fulvous patch in and beyond end of cell, with traces of a hyaline point at middle of cell and a prominent discoidal hyaline spot; an indistinct fulvous postmedial line slightly bent outwards between veins 6 and 2, then retracted to lower angle of cell and slightly bent outwards again; an indistinct curved submarginal line. Hind wing with irregularly waved ante- and postmedial and submarginal lines, the two latter anastomosing towards tornus.

Hab. Amboina; Humboldt Bay, N. Guinea (*Doherty*). *Exp.* 20 mm. Types in Coll. Rothschild and B.M.

(14)†Sameodes hilarodes Meyr. Trans. Ent. Soc. 1894, p. 465. Borneo; Pulo Laut.

(15)†Sameodes distictalis, n. sp.

Differs from *hilarodes* in the antemedial line of fore wing being almost obsolete; no hyaline spot below the cell and the retracted portion of the postmedial line straight; the postmedial line bent inwards below costa, with a hyaline spot on its inner side instead of the hyaline band on its outer side. Hind wing with large hyaline spot in end of cell.

Hab. Pulo Laut (*Doherty*). *Exp.* 18 mm. Type in B.M.

(16)†Sameodes flavidissimalis Grote, Can. Ent. ix. p. 105. U.S.A.

(17) Sameodes cambogialis Guen. Delt. & Pyr. p. 331.
†*Botys lucilla* Butl. P. Z. S. 1878, p. 494. W. Indies; Brazil.

(18)†Sameodes citrinalis, n. sp.

♂. Pale lemon-yellow. Fore wing with oblique antemedial fuscous line; a large fuscous patch filling the end of cell, the area just beyond it, and extending up to costa, with a hyaline spot in end of cell and an oblique series of five spots beyond the cell between the veins; a submarginal fuscous line obtusely angled at vein 5. Hind wing yellowish white.

Hab. Dominica (*W. H. Elliot*). *Exp.* 18 mm.

(19)*Sameodes polythliptalis, n. sp.

♂. Fuscous suffused with grey; palpi white at base; abdomen ringed with white and with the ventral surface white. Fore wing with dark-edged hyaline spot in and below middle of cell, with traces of a line from it to inner margin; a rounded spot in end of cell; a diamond-shaped spot below vein 2 near its origin, and a dentate postmedial band formed of four conjoined spots between costa and vein 5. Hind wing semihyaline yellow with the base fuscous; triangular fuscous marks from costa at and beyond end of cell; the terminal area fuscous suffused with grey, with irregular dark line on its inner edge and dark terminal line; cilia white.

Hab. Humboldt Bay, N. Guinea (*Doherty*). *Exp.* 26 mm. Type in Coll. Rothschild.

Genus 91. Meroctena.

Meroctena Led. Wien. Ent. Mon. 1863, p. 392.

Palpi porrect, straight, the 2nd joint fringed above and below

Fig. 91.

Meroctena tullalis, ♂. ½. (From Moths Ind. vol. iv.)

with hair, the 3rd naked; maxillary palpi filiform; tibiæ of male with the outer spurs minute; abdomen with the anal tuft very large. Fore wing with veins 3, 4, 5 from close to angle of cell; 7 curved and approximated to 8, 9 for some distance; 10 also approximated to 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 from upper angle, 7 anastomosing with 8.

Sect. I. Antennæ of male unipunctate for one-third length, the basal joint emitting four teeth enclosing a hollow in front like the calyx of a flower.

Type. (1)†Merocteña tullalis Wlk. xviii. 649; Hmpsn. Ill. Het. ix. pl. 172. f. 11. Indian & Malayan subregions.

(2) Merocteña staintoni Led. Wien. Ent. Mon. 1863, p. 392, pl. 13. f. 4. Pulo Laut; Java; Fiji.
†*Lygropis sirioxantha* Meyr. Trans. Ent. Soc. 1886, p. 262.

Sect. II. Antennæ of male with the basal half serrate and fasciculate, a large tuft of scales on upperside at one-fifth from base; palpi with the 3rd joint short, flattened, rounded, the outer side hollowed out and curled over at tip.

(3)†Merocteña dichochrosialis, n. sp. (1898, Plate L. fig. 22.)

♂. Orange; fore tibiæ with black band; abdomen with two conjoined dorsal black spots on subbasal segment and dorsal band on subterminal segment with silvery-white posterior edge. Fore wing with black spot at base of costa; an antemedial black line expanding into a spot on costa; a discoidal lunule; the postmedial line represented by an oblique straight line from costa to vein 5, a subterminal spot on vein 4 and small spot below vein 2, and a large spot near base of vein 2. Hind wing with large lunule beyond to cell; a subterminal spot between veins 2 and 4 and an oblique line from near lower angle of cell becoming obsolete before tornus; both wings with fine terminal line.

Hab. Bali, 2500 feet (*Doherty*). *Exp.* 30 mm.

Genus 92. Thliptoceras.

Thliptoceras Swinh. Trans. Ent. Soc. 1890, p. 274.
Prophantis Warr. A. M. N. H. (6) xviii. p. 113 (1896).

Palpi porrect, straight, about twice the length of head, the 2nd

Fig. 92.

Thliptoceras cascale, ♂. ½. (From Moths Ind. vol. iv.)

joint fringed above and below with hair, the 3rd prominent; maxillary palpi filiform; frons rounded; hind tibiæ with the outer medial spur minute. Fore wing produced at apex, the outer margin oblique; veins 3, 5 from close to angle of cell; 7 straight and well separated from 8, 9. Hind wing with the cell short; the discocellulars produced along vein 4, which is approximated to 5; 6, 7 stalked, 7 anastomosing strongly with 8.

Sect. I. (*Thliptoceras*). Antennæ of male with two curved teeth on basal joint forming an upturned cavity, the basal part of shaft curved, then expanded into a cavity formed of short appressed pectinations.

Type. (1)†Thliptoceras cascale Swinh. Trans. Ent. Soc. 1890, p. 271, pl. 8. f. 18. Japan; India, Ceylon, & Burma.
Thliptoceras variabilis Swinh. Trans. Ent. Soc. 1890, p. 274; Hmpsn. Ill. Het. viii. pl. 156. ff. 2, 10.
Circobotys phycidalis Snell. Trans. Ent. Soc. 1890, p. 599.

Sect. II. Antennæ of male with the basal joint excised and with a slight tuft of hair from inner side; fore wing less produced at apex, the costa highly arched before middle. Hind wing with the inner area clothed with long hair; patagia extending beyond metathorax.

(2)*Thliptoceras stygiale Hmpsn. Moths of India, iv. p. 378. Assam.

Sect. III. (*Prophantis*). Antennæ of male ciliated.

(3) Thliptoceras octoguttale Feld. Reis. Nov. pl. 135. f. 38. Natal; Indian & Malayan subregions to Australia.
†*Pyralis smaragdina* Butl. A. M. N. H. (4) xvi. p. 411 (1875).

(4)*Thliptoceras distictalis, n. sp.

♀. Head, thorax, and abdomen pale reddish brown; palpi blackish at sides, whitish below; wings purplish brown. Fore wing with two obliquely placed orange subbasal points and some diffused orange on inner margin; a white bar across end of cell and spot below end; the costa orange, with 6 or 7 black points from above end of cell to the wedge-shaped subterminal band which ends on vein 5; termen and cilia orange with purplish points. Hind wing with some diffused orange on basal area, and two spots in cell conjoined to the whitish costal area; a medial yellow band narrowing to inner margin; the termen and cilia orange.
Hab. Katha, Burma. *Exp.* 28 mm. Type in Coll. Rothschild.

(5)†Thliptoceras cœnostolalis, n. sp.

♂. Head and tegulæ ochreous; palpi black at sides, white below;

thorax and abdomen fuscous, the latter ochreous towards extremity. Fore wing fuscous grey, with diffused blackish antemedial patch; the costa from it to apex orange; a triangular yellow medial patch before the postmedial line extending down to vein 2 and containing a dark-edged orange discoidal spot; the postmedial line oblique, slightly excurved between veins 5 and 2, then retracted to below end of cell. Hind wing fuscous, with obscure medial line; both wings with the cilia yellow, except at middle. Underside of fore wing with two dark-edged orange spots in cell.

Hab. Sierra Leone (*Clements*). *Exp.* 22 mm.

(6)†Thliptoceras polygrammodes, n. sp.

Head, thorax, and abdomen rufous; vertex of head yellowish; abdomen with two white spots on 1st segment. Fore wing rufous; a very ill-defined yellowish antemedial band not reaching the costa; a quadrate spot in end of cell; a large postmedial yellow area not reaching the costa and traversed by the postmedial sinuous line, which has a series of yellow spots beyond it from costa to vein 2, where it is retracted to lower angle of cell. Hind wing yellow with the base rufous; a rounded rufous discoidal spot; a sinuous postmedial line bent outwards between veins 5 and 2, then retracted to below angle of cell; the terminal area rufous with waved inner edge.

Hab. Natal, Mooi River. *Exp.* 40 mm.

Genus 93. Archernis.

Archernis Meyr. P. Linn. Soc. N.S.W. ii. 1, p. 254 (1886).
Protonoceras Warr. A. M. N. H. (6) vi. p. 457 (1890).
Metaporthra Meyr. Trans. Ent. Soc. 1894, p. 463.
Chrysommatodes Warr. A. M. N. H. (6) xvii. p. 105 (1896).

Palpi porrect, long and straight, the 2nd joint fringed with hair below, the 3rd prominent; maxillary palpi long and slightly dilated

Fig. 93.

Archernis capitalis, ♂. ½. (From Moths Ind. vol. iv.)

with scales; frons rounded. Fore wing with veins 3, 4, 5 separate at origin; 7 nearly straight and well separated from 8, 9. Hind wing with the cell short; the discocellulars erect; veins 3, 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing with 8.

SECT I. (*Protonoceras*). Male with a tuft of forwardly directed hair between the antennæ; antennæ with basal joint dilated, the shaft given off from its outer side, much bent near base, then with some small serrations on inner side and with long cilia.

A. Antennæ of male with long curved tuft of hair from inner side of basal joint, the tuft between antennæ long.

(1)†ARCHERNIS CAPITALIS Fabr. Suppl. Ent. Syst. p. 468 (1798). Formosa; India, Ceylon, & Burma.
Botys tropicalis Wlk. xviii. 670; Moore, Lep. Ceyl. iii. pl. 181. f. 9.

B. Antennæ of male without the curved tuft from basal joint, the frontal tuft less developed.

(2) ARCHERNIS DOLOPSALIS Wlk. xviii. 692. S. India, Ceylon, Burma; Borneo; Mysol.
Botys fimbripunctalis Wlk. xxxiv. 1425.
†*Protonoceras fuscilunalis* Hmpsn. Ill. Het. viii. p. 134, pl. 155. f. 22.

SECT. II. Antennæ of male serrate at base and with a tuft of hair on inner side at one-third.

(3)†ARCHERNIS FULVALIS Hmpsn. Journ. Bomb. Nat. Hist. Soc. ined. Sikhim; Ceylon.

SECT. III. Antennæ of male normal.

(4)†ARCHERNIS HUMILIS Swinh. A. M. N. H. (6) xiv. p. 146. Assam.

(5)†ARCHERNIS NICTITANS Swinh. A. M. N. H. (6) xiv. p. 146. Assam.

(6)*ARCHERNIS LUGENS Warr. A. M. N. H. (6) xviii. p. 110. Assam.

(7)*ARCHERNIS SCOPULALIS Wlk. xxxiv. 1438. Flores.

Type (8) ARCHERNIS CALLIXANTHA Meyr. P. Linn. Soc. N.S.W. ii. 1, p. 254. Pulo Laut; New Guinea; Australia.
Chrysommatodes æreoflavalis Warr. A. M. N. H. (6) xvii. p. 105.

(9)†ARCHERNIS OBLIQUIALIS Hmpsn. Moths Ind. iv. p. 380. Sikhim.

(10) ARCHERNIS IGNEALIS Wlk. xxxiv. 1423. Mysol; N. Guinea; Queensland.

Genus 94. TERASTIA.

Terastia Guen. Delt. & Pyr. p. 211 (1854).

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair;

maxillary palpi filiform; frons flat and oblique; antennæ of male ciliated; fore tibiæ fringed with long hair; mid and hind tibiæ with the outer spurs about half the length of inner; abdomen of male with lateral tufts on the last three segments, the anal tuft long. Fore wing long and narrow, the costa arched towards apex, which is produced, the outer margin excurved at middle; the inner margin excised before the outer angle, which is lobed; vein 3 from close to angle of cell; 4, 5 somewhat approximated for a short distance; 7 curved and approximated to 8, 9. Hind wing ample; the costa highly excised before and after middle; lobed at middle and towards apex; veins 4, 5 somewhat approximated for a short distance; the discocellulars erect; veins 6, 7 from upper angle, 7 touching but not anastomosing with 8.

Fig. 94.

Terastia meticulosalis, ♂. ½. (From Moths Ind. vol. iv.)

(1) TERASTIA EGIALEALIS Wlk. xvii. 383. Himalayas; Java.
„ *procelalis* Led. Wien. Ent. Mon. 1863, p. 416.
†*Agathodes diversalis* Wlk. xxxiv. 1307.
†*Megaphysa quadriferalis* Wlk. xxxiv. 1628.

Type. (2) TERASTIA METICULOSALIS Guen. Delt. & Pyr. p. 212. W. Indies; Ceylon; Java;
„ *subjectalis* Led. Wien. Ent. Mon. 1863, p. 480. Philippines.
†*Megaphysa quadratalis* Wlk. xxxiv. 1527.
Megastes cœligenalis Hulst, Tr. Am. Ent. Soc. xiii. p. 156.

(3) TERASTIA MARGARITIS Feld. Reis. Nov. pl. 136. f. 40. Natal.

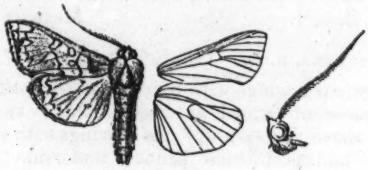
Genus 95. MEGASTES.

Megastes Guen. Delt. & Pyr. p. 375 (1854).

Palpi porrect, extending about the length of head, the 2nd joint fringed with hair below, the 3rd prominent and thickly scaled; maxillary palpi triangularly dilated with scales; frons rounded; antennæ of male bipectinate; build stout; tibiæ with the outer spurs about half the length of inner. Fore wing with the costa highly arched towards apex, which is somewhat produced; the inner margin excised before outer angle, which is hooked; veins 3, 4, 5 from angle of cell; 7 curved and approximated to 8, 9. Hind wing with the cell half the length of wing; vein 3 from angle; 4,

5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 95.



Megastes grandalis, ♂. ½.

Type. (1) MEGASTES GRANDALIS Guen. Delt & Pyr. p. 376. Venezuela.

(2)*MEGASTES SPILOSOMA Feld. Reis. Nov. pl. 135. f. 48. Brazil.

Auctorum.

Megastes pusialis Snell. Tijd. v. Ent. xviii. p. 241, pl. 13. f. 15. Brazil.

Genus 96. OMPHISA.

Omphisa Moore, Lep. Ceyl. iii. p. 317 (1886).

Palpi porrect and straight, the 2nd joint fringed with hair below, the 3rd prominent; maxillary palpi well-developed and filiform; frons rounded; antennæ of male ciliated; patagia clothed with large scales; tibiæ with the outer spurs about half the length of inner, mid tibiæ clothed on outer side with spinous hair; abdomen with large lateral tufts on last five segments. Fore wing with veins 3, 4, 5 well separated at origin; 7 nearly straight and well separated from 8, 9; the costa arched towards apex, which is acute; the outer margin excurved at middle. Hind wing with the costa slightly excised at middle; the apex somewhat produced; the outer margin excurved at middle; the inner margin short; veins 4 and 5 approximated for a short distance; 6, 7 from upper angle, 7 free or anastomosing with 8.

Fig. 96.

Omphisa anastomosalis, ♂. ½. (From Moths Ind. vol. iv.)

Type. (1) OMPHISA ANASTOMOSALIS Guen. Delt. & Pyr. p. 373. China; India, Ceylon, & Burma; Andamans; Duke of York I.

†*Botys illisalis* Wlk. xviii. 653; Moore, Lep. Ceyl. iii. pl. 183. f. 4. Java;

(2) Omphisa repetitalis Snell. Trans. Ent. Soc. 1890, p. 621, pl. xix. f. 6. Sikhim.

(3)*Omphisa praxiteles Druce, Biol. Centr.-Am., Het. ii. p. 215, pl. 61. ff. 3, 4. Mexico; Centr. Amer.

(4) Omphisa ingens, n. sp. (1898, Plate L. fig. 17.)

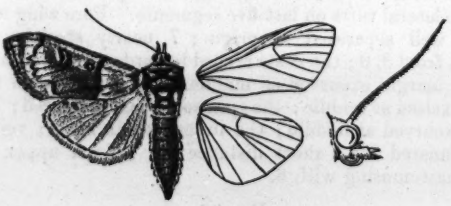
Yellowish rufous; wings with numerous fine dark striæ. Fore wing with traces of curved antemedial line; two dark spots towards apex above veins 6 and 7; both wings with very ill-defined darker medial and postmedial bands; underside with blackish discoidal marks on each wing.

Hab. Fergusson I., N. Guinea (*Meek*). *Exp.* 66 mm. Types in Coll. Rothschild and B.M.

Genus 97. Laniifera, nov.

Palpi porrect, straight, and extending about the length of head, the 2nd joint clothed below with very long hair extending to end of the well-developed naked 3rd joint; maxillary palpi filiform; frons rounded; antennæ ciliated; vertex of head and thorax clothed with rough hair and scales; build stout; femora and tibiæ clothed with rough hair. Fore wing clothed with rather woolly hair; the costa arched towards apex; veins 3, 4, 5 from angle of cell; 7 curved and approximated to 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 stalked, 7 anastomosing slightly with 8.

Fig. 97.



Laniifera cyclades, ♂. ½.

Type. Laniifera cyclades Druce, Biol. Centr.-Am., Het. ii. p. 220, pl. 61. f. 12. Mexico.

Genus 98. Orenaia.

Orenaia Dup. Cat. Méth. p. 196 (1831).

Palpi porrect, the 2nd joint fringed with long hair below, the 3rd prominent; maxillary palpi slightly dilated with scales; frons rounded; antennæ ciliated; tibiæ slightly scaled; wings short and broad. Fore wing with veins 3, 4, 5 well separated at origin; 7 straight and well separated from 8, 9. Hind wing with veins 3,

4, 5 from end of cell; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 98.

Orenaia alpestralis, ♂. ½.

(1) ORENAIA HELVETICALIS H.-S. vi. p. 141, f. 127. Europe.
Hercyna lugubralis Led. Wien. Ent. Mon. 1857, p. 82 (var.).
„ *conspurcalis* Lah. Suppl. p. 32.

(2) ORENAIA RUPESTRALIS Hübn. Pyr. ff. 201–203. C. Europe.
Hercyna andereggialis H.-S. vi. p. 140, ff. 124–126.

Type. (3) ORENAIA ALPESTRALIS Fabr. Ent. Syst. 350. Europe.
Crambus alpestris Fabr. Suppl. 466.
„ *alpina* Hübn. Vög. & Schm. 21.

Auctorum.

Hercyna expansalis Eversm. Bull. Mosc. 1852, i. p. 168.
Ural Mts.

Genus 99. EVERGESTIS.

Evergestis Hübn. Verz. p. 354 (1827).
Homochroa Hübn. Verz. p. 358.
Scopolia Hübn. Verz. p. 368.
Orobena Guen. Delt. & Pyr. p. 376 (1856).
Parœdis Grote, Check-List, i. p. 51 (1882).

Palpi porrect, the 2nd joint fringed with hair below, the 3rd naked; maxillary palpi long and filiform; frons oblique; antennæ ciliated; tibiæ with the outer spurs two-thirds length of inner.

Fig. 99.

Evergestis frumentalis, ♂. ½.

Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 from upper angle, 7 anastomosing with 8.

(1)†Evergestis funalis Grote, Bull. U.S. Geol. Surv. iv. 670. U.S.A.

(2) Evergestis bruneogrisea Edw. Am. Ent. ii. p. 171. U.S.A.

(3) Evergestis napæalis Hulst, Tr. Am. Ent. Soc. xiii. p. 145. U.S.A.

(4) Evergestis obliqualis Grote, Pr. Kans. Ac. viii. p. 56. U.S.A.

(5) Evergestis rimosalis Guen. Delt. & Pyr. p. 371. U.S.A.

(6) Evergestis sophialis Fabr. Mant. ii. p. 217. Europe.
Phalæna variegalis Fabr. Mant. ii. p. 218.

(7) Evergestis segetalis H.-S. vi. p. 142, f. 132. S. Europe;
Orobena blandalis Guen. Delt. & Pyr. p. 377. W. Asia.

(8) Evergestis frumentalis Linn. Syst. Nat. no. 337. Europe; W. Asia; Siberia.
Pyralis triquetralis Schiff. Wien. Verz. p. 120.
„ *repandalis* Hübn. Pyr. f. 64.
„ *implicalis* Guen. Delt. & Pyr. p. 379.
„ var. *asiaticalis* Rag. Ann. Soc. Ent. Fr. 1894, p. 168.

(9) Evergestis umbrosalis F. R. p. 274, pl. 92. f. 2.
Orobena orientalis Eversm. Bull. Mosc. 1842. W. & C. Asia.

(10) Evergestis nomadalis Led. Hor. Ent. Ross. 1871, p. 22, pl. 2. f. 10. Persia; Amur.

(11) Evergestis extimalis Scop. Ent. Carn. p. 614. U.S.A.;
Pyralis margaritalis Schiff. Wien. Verz. p. 123. Europe.
„ *erucalis* Hübn. Pyr. f. 55.
Evergestis consimilis Warr. A. M. N. H. (6) ix. p. 433.

(12) Evergestis straminalis Hübn. Vög. & Schmett. 82.
Pyralis elutalis Hübn. Pyr. f. 62. U.S.A.; Europe.
†*Pionea eunusalis* Wlk. xviii. 756.

(13) Evergestis politalis Schiff. Wien. Verz. p. 121. S. Europe.
Orobena dispersalis Mann. Wien. Ent. Mon. 1859, p. 162 (var.).
„ *bicoloralis* Lah. Contr. p. 21.

Type. (14) Evergestis limbata Linn. Syst. Nat. xii. 873. S. Europe;
Mesographe prætextalis Hübn. Verz. p. 354. W. Asia.
Pyralis politalis Hübn. Pyr. f. 61.

(15) Evergestis junctalis Warr. A. M. N. H. (6) ix. p. 434. Japan.

(16) Evergestis subfuscalis Staud. Hor. Ent. Ross. 1870, p. 192, pl. 2. f. 9. S. Europe; W. Asia.

(17) Evergestis ænealis Schiff. Wien. Verz. p. 123. Europe.
Pyralis furvalis Hübn. Pyr. f. 53.
„ *rufimitralis* Hübn. Pyr. f. 120.

Auctorum.

Orobena lemniscalis Möschl. Verh. z.-b. Wien, xxxi. p. 425. Surinam.
„ *grummi* Chr. Rom. Mém. ii. p. 147, pl. vii. f. 14. C. Asia.
„ *subcitrinalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 157. U.S.A.
„ *seminivealis* Hulst, Tr. Am. Ent. Soc. xiii. p. 157. U.S.A.
„ *manglisalis* Ersch, Hor. Ent. Ross. xii. p. 339, & Rom. Mém. iii. pl. ii. f. 8. Transcaucasus.
Hercyna anartalis Stgr. Deutsche E. Zeit., Lep. v. pl. iii. f. 17, & vi. p. 72. C. Asia.
Scopolia helenalis Stgr. Hor. Ent. Ross. 1870, p. 195, pl. ii. f. 12. E. Europe; W. Asia.
Orobena allardalis Oberth. Bull. Soc. Ent. Fr. (6) vii. p. xcix, & Et. Ent. xii. pl. vii. f. 54. Algeria.
Eurycreon pechi Baker, Ent. Mo. Mag. xxi. p. 268. Algeria.
Orobena renatalis Oberth. Bull. Soc. Ent. Fr. (6) vii. p. xcix, & Et. Ent. xii. pl. vi. f. 36. Algeria.
Botys seriazatis Stgr. Deutsche E. Zeit., Lep. v. pl. iii. f. 15, & vi. p. 79. Algeria.
„ *cæsialis* H.-S. iv. p. 115, f. 116. Europe.
Orobena vagabundalis Christ. S. E. Z. xlviii. p. 166, & Rom. Mém. iii. pl. iii. f. 7. Persia.
„ *infirmalis* Stgr. Hor. Ent. Ross. 1870, p. 190, pl. ii. f. 13. S.E. Europe.
Pionea bifascialis Guen. Alg. iii. p. 403, & Oberth. Et. Ent. xii. pl. vi. f. 40. Algeria.
Orobena submundalis Mill. Ann. Soc. L. Lyon. xxix. p. 160, pl. ii. f. 2. S. France.
Scopula mundalis Guen. Delt. & Pyr. p. 389. S. Europe.
Orobena implicitalis Möschl. Abh. Senck. Ges. xvi. p. 292. Porto Rico.
„ *plumbo-fascialis* Rag. Ann. Soc. Ent. Fr. 1894, p. 168. Spain.

Genus 100. Ischnurges.

Ischnurges Led. Wien. Ent. Mon. 1863, p. 418.
Nesolocha Meyr. Trans. Ent. Soc. 1886, p. 239.
Rhectothyris Warr. A. M. N. H. (6) vi. p. 474 (1890).
Stenochora Warr. A. M. N. H. (6) ix. p. 298 (1892).

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair;

Fig. 100.

Ischnurges gratiosalis, ♂. ½. (From Moths Ind. vol. iv.)

maxillary palpi filiform; frons flat and oblique; antennæ annulate; tibiæ with the outer spurs about half the length of inner. Fore wing with veins 3, 4, 5 from near angle of cell; 7 straight and well separated from 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 from upper angle, 7 anastomosing with 8.

(1)†Ischnurges gratiosalis Wlk. xvii. 357; Hmpsn. Ill. Het. ix. pl. 173. f. 12. China; India; Ceylon; Borneo.
†*Asopia roridalis* Wlk. xvii. 371.

(2) Ischnurges rosea Warr. A. M. N. H. (6) xvii. p. 142. Assam.

(3) Ischnurges lancinalis Guen. Delt. & Pyr. p. 169. S. Africa.
Botys expeditalis Led. Wien. Ent. Mon. 1863, p. 372, pl. 9. f. 15.

(4)†Ischnurges perpulchralis, n. sp. (1898, Plate L. fig. 24.)

♀. Head bright pink, the vertex yellow; thorax bright yellow, shoulders with pink stripes; pectus white; abdomen yellow, the last four segments pink. Fore wing bright yellow, the costa and terminal third bright pink; an antemedial pink line angled below the cell and a spot at middle of cell, both sometimes almost entirely obsolete; the inner edge of terminal pink area sinuous; a large yellow patch beyond the cell between veins 7 and 2, its inner edge encroached on by pink scales above and below middle. Hind wing white; the terminal area yellowish suffused with pink scales, most widely at vein 2.
Hab. Mexico, Orizaba (*Schaus*). *Exp.* 22 mm.

(5)†Ischnurges rufalis Hmpsn. Ill. Het. ix. p. 163, pl. 172. f. 28. Ceylon.

(6)†Ischnurges argentalis Hmpsn. Ill. Het. ix. p. 163, pl. 173. f. 16. Ceylon.

(7)†Ischnurges luteomarginalis Hmpsn. Ill. Het. viii. p. 134, pl. 155. f. 18. S. India.

(8)†Ischnurges angustalis Hmpsn. Ill. Het. ix. p. 173, pl. 172. f. 20. Ceylon; Burma.

Type. (9) Ischnurges illustralis Led. Wien. Ent. Mon. 1863, p. 418, pl. 15. f. 12. New Guinea; Australia.
Nesolocha autolitha Meyr. Trans. Ent. Soc. 1886, p. 240.

(10)†Ischnurges discophoralis, n. sp.

Black-brown with a slight yellowish gloss; pectus and ventral surface of abdomen white. Fore wing with the costal area purplish; a semihyaline yellow spot below origin of vein 2; a dark discoidal spot with yellow point before it and large yellow lunulate patch beyond it between veins 7 and 2 running inwards below end of cell; cilia whitish towards tornus. Hind wing pale

semihyaline yellow, with black discoidal spot; the terminal area fuscous, with its inner edge slightly indented between veins 5 and 2; cilia whitish at tips.

Hab. Orizaba, Mexico (*Schaus*). *Exp.* 20 mm.

Genus 101. Hyalobathra.

Hyalobathra Meyr. Trans. Ent. Soc. 1886, p. 445.
Isocentris Meyr. Trans. Ent. Soc. 1887, p. 232.
Leucocraspeda Warr. A. M. N. H. (6) vi. p. 475 (1890).

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi filiform; frons flat and oblique; antennæ ciliated; tibiæ with the spurs long and nearly equal. Fore wing with veins 3, 4, 5 from angle of cell; 7 straight and well separated from 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 101.

Hyalobathra filalis, ♂. ½. (From Moths Ind. vol. iv.)

Sect. I. (*Hyalobathra*). Hind wing of male with a hyaline fovea in base of cell.

Type. (1) Hyalobathra archeleuca Meyr. Trans. Ent. Soc. 1885, p. 445. Burma; Perak; Borneo; Queensland; New South Wales.
Isocentris unicolor Warr. A. M. N. H. (6) xvi. p. 472.

Sect. II. (*Isocentris*). Hind wing of male without fovea in cell.

(2)†Hyalobathra phœnicozona Hmpsn. Moths Ind. iv. p. 385. Assam.

(3) Hyalobathra filalis Guen. Delt. & Pyr. p. 204; Snell. Tijd. v. Ent. 1883, pl. 7. f. 11. Mauritius; Oriental region to Australia.
†*Endotricha rhodophilalis* Wlk. xxxiv. 1311; Moore, Lep. Ceyl. iii. pl. 178. f. 13.
†*Botys amœnalis* Wlk. xxxiv. 1445.
„ *auralis* Snell. Tijd. v. Ent. 1872, p. 90, pl. 7. ff. 9, 10.
†*Samea dives* Butl. P. Z. S. 1880, p. 682.

(4) Hyalobathra æqualis Led. Wien. Ent Mon. 1863, p. 468, pl. 10. f. 3. India, Ceylon, & Burma; Celebes.
†*Isocentris undulilinea* Hmpsn. Ill. Het. viii. p. 132, pl. 154. f. 21.

(5) HYALOBATHRA CŒNOSTOLALIS Snell. Trans. Ent. Soc. 1880, p. 582. N.E. & S. India; Burma.
†*Leucocraspeda udeoides* Hmpsn. Ill. Het. viii. p. 134, pl. 155. f. 17.

(6)†HYALOBATHRA ILLECTALIS Wlk. xviii. 658; Hmpsn. Ill. Het. ix. pl. 173. f. 9. N.E. India; Ceylon; Burma; Borneo; Celebes.
Botys albofimbrialis Snell. Tijd. v. Ent. 1883, p. 128.
„ *niveicilialis* Snell. Midd.-Sum., iv. Lep. p. 64.

(7)†HYALOBATHRA OPHELTISALIS Wlk. xix. 1010. India; Burma.
†*Hedylepta contubernalis* Moore, Lep. Atk. p. 208.

(8) HYALOBATHRA MINIOSALIS Guen. Delt. & Pyr. p. 362.
†*Ebulea europsalis* Wlk. xviii. 749. India, Ceylon, & Burma.
† „ *orseisalis* Wlk. xviii. 749.

(9) HYALOBATHRA MINIALIS Warr. A. M. N. H. (6) xvi. p. 477. Queensland.

(10)*HYALOBATHRA LÆTALIS Stgr. List, xxxiii. Europe.

Genus 102. AZOCHIS.

Azochis Wlk. xviii. 542 (1859).

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi filiform; frons oblique; antennæ of male ciliated; tibiæ with the outer spurs about one-third length of inner; male with tufts of hair on extremity of hind tibiæ and 1st joint of tarsus; abdomen long, with large anal tuft. Fore wing rather long and narrow; veins 3, 4, 5 from angle of cell; 7 curved and closely approximated to 8, 9 for nearly half its length. Hind wing of male with the membrane above tornus contorted and clothed with coarse black hair above and below; the cell short; vein 3 from angle; 4, 5 approximated for a short distance; 6, 7 shortly stalked, 7 anastomosing with 8.

Fig. 102.

Azochis gripusalis, ♂. ½.

(1)*AZOCHIS MACTALIS Feld. Reis. Nov. pl. 135. f. 50. Fiji.

Type. (2)†AZOCHIS GRIPUSALIS, Wlk. xviii. 542. Brazil.
Botys saniosalis Led. Wien. Ent. Mon. 1863, p. 371, pl. 9. f. 11.

(3)†AZOCHIS RUFIFRONTALIS Hmpsn. A. M. N. H. (6) xvi. p. 339. W. Indies.

Genus 103. Crocidophora.

Crocidophora Led. Wien. Ent. Mon. 1863, p. 386.
Stenophyes Led. Wien. Ent. Mon. 1863, p. 388.
Circobotys Butl. Ill. Het. iii. p. 77 (1879).
Chobera Moore, Lep. Atk. p. 219 (1888).
Tanaophysa Warr. A. M. N. H. (6) ix. p. 389 (1892).
Mimocomma Warr. A. M. N. H. (6) xvi. p. 473 (1895).
Monocrocis, Warr. A. M. N. H. (6) xvi. p. 475.
Polychorista Warr. A. M. N. H. (6) xviii. p. 109 (1896).

Palpi porrect and triangularly scaled, the 3rd joint hidden by hair; maxillary palpi filiform; frons flat and oblique; antennæ of male nearly as long as the fore wing and minutely ciliated; hind tibiæ with the outer spurs minute; abdomen of male long, the claspers and anal tuft large. Fore wing more or less produced at apex, the outer margin oblique; veins 3 and 5 from near angle of cell; 7 straight and well separated from 8, 9. Hind wing with the cell short; veins 4, 5 approximated for a short distance; 6, 7 stalked, 7 anastomosing strongly with 8.

Fig. 103.

Crocidophora ptyophora, ♂. ½. (From Moths Ind. vol. iv.)

Sect. I. (*Polychorista*). Antennæ of male with a curved tooth of scales from basal joint, the basal part of shaft slightly thickened and contorted; hind wing with the base of costa expanded into a large folded lobe.

(1)†Crocidophora calvatalis Swinh. Trans. Ent. Soc. 1890, p. 275. Burma.

Sect. II. Antennæ of male slightly knotted and contorted at one-fifth from base.

(2)†Crocidophora epicrocalis Swinh. Trans. Ent. Soc. 1890, p. 275. S. India; Burma.
†*Circobotys marginalis* Hmpsn. Ill. Het. viii. p. 133, pl. 155. f. 1 (♂).

Sect. III. (*Mimocomma*). Antennæ of male with the base of shaft excised and a tuft of hair beyond the excision.

(3) Crocidophora fulvimargo Warr. A. M. N. H. (6) xvi. p. 473. N.E. India; Burma.

Sect. IV. Antennæ of male normal.

A. Retinaculum of male formed by a very large fan of leaden-coloured scales from below median nervure, the median nervure bent upwards.

a. (*Crocidophora*). Fore wing of male with a fan of leaden-coloured scales beyond upper angle of cell and vein 7 bent downwards.

(4)†Crocidophora ptyophora Hmpsn. Moths Ind. iv. p. 389. N.E. India; Burma.

(5) Crocidophora amœnalis Snell. Trans. Ent. Soc. 1890, p. 598. Sikhim.

(6)†Crocidophora limbolalis Moore, P. Z. S. 1877, p. 615. N.E. India; Burma; Andamans.

(7)*Crocidophora curvilinealis, n. sp.

♂. Pale yellow; sides of head and shoulders rufous; abdomen fulvous above and with white dorsal segmental lines. Fore wing with the costal area fulvous; a curved antemedial line; a discoidal patch and lunule; the postmedial line excurved and punctiform from below costa to vein 3, angled inwards above veins 2 and 1, and joined by a streak on inner margin to the antemedial line; a purplish-fuscous band just before termen; termen and cilia yellow with a series of dark points. Hind wing suffused with fuscous to beyond middle, its outer edge angled at vein 2; an oblique purplish-fuscous band from costa before apex to termen at middle; a terminal series of points.

Hab. Khásis. *Exp.* 24 mm. Type in Coll. Rothschild.

(8) Crocidophora fulvidalis Warr. A. M. N. H. (6) xvi. p. 475. Assam.
Lepidoplaga uniformis Warr. A. M. N. H. (6) xvi. p. 476.

(9)†Crocidophora serratissimalis Zell. Verh. z.-b. Wien, 1872, p. 521. U.S.A.
†*Botis subdentalis* Grote, Bull. Buff. Soc. i. p. 173.

(10) Crocidophora pustuliferalis Led. Wien. Ent. Mon. 1863, p. 386, pl. 12. f. 11. U.S.A.

Type. (11) Crocidophora tuberculalis Led. Wien. Ent. Mon. 1863, p. 386, pl. 12. f. 9. U.S.A.

(12) Crocidophora multidentalis Warr. A. M. N. H. (6) xvi. p. 476. Assam.

b. (*Monocrocis*). Fore wing of male with a small postmedial glandular swelling on costa and an elongate groove of almost unscaled ribbed membrane above vein 7.

(13) Crocidophora lutusalis Snell. Trans. Ent. Soc. 1890, p. 596. N.E. & W. India.

(14) Crocidophora flavofasciata Moore, Lep. Atk. p. 223, pl. 7. f. 19. N.E. India.

c. Fore wing of male without sexual characters beyond the cell.

(15) Crocidophora fasciata Moore, Lep. Atk. p. 223, pl. 7. f. 20. N.E. India.

(16)†Crocidophora distinctalis Swinh. A. M. N. H. (6) xiv. p. 144. Assam.

(17)†Crocidophora evenoralis Wlk. Cat. xix. 1012, 1015. Japan; China; Burma.
Botis mandarinalis Leech, Entom. 1889, p. 68, pl. 3. f. 14.

(18)†Crocidophora habisalis Wlk. xviii. 702. Borneo.
†*Rhodaria mœvialis* Wlk. xix. 925.

(19)†Crocidophora discolorata Swinh. A. M. N. H. (6) xiv. p. 144. Assam.

(20)†Crocidophora pallidulalis Swinh. A. M. N. H. (6) xiv. p. 141. Assam.

B. (*Circobotys*). Retinaculum of male normal.

a. Fore wing of male with a large fovea below base of cell, but without fan of scales.

(21) Crocidophora heterogenalis Brem. Lep. Ost-Sib. p. 70, pl. 6. f. 11. Amur; Japan.

b. (*Tanaophysa*). Fore wing of male with a streak of ribbed hyaline membrane above vein 7, no fovea below the cell.

(22)†Crocidophora adornatalis Warr. A. M. N. H. (6) ix. p. 389. Brazil.

c. (*Stenophyes*). Fore wing of male without secondary sexual characters.

a'. Fore wing produced and subfalcate.

(23)†Crocidophora nycterina Butl. Ill. Het. iii. p. 77, pl. 59. f. 14. Japan.

(24) Crocidophora limbata Moore, Lep. Atk. p. 220, pl. 7. f. 24. N.E. India.

(25) Crocidophora aurimargo Warr. A. M. N. H. (6) xviii. p. 109. Assam.

(26) Crocidophora gladialis Leech, Entom. xxii. p. 67, pl. 3. ff. 5, 15. China.

(27) Crocidophora pallida Moore, Lep. Atk. p. 220. N.E. India.

b'. Fore wing less produced and not subfalcate.

(28)†Crocidophora sinisalis Wlk. xviii. 635. W. Africa; Punjab.

(29)†Crocidophora fuscalis Hmpsn. Ill. Het. viii. p. 133, pl. 154. f. 14. S. India.

(30) Crocidophora stenophilalis Wlk. xxxiv. 1407. S. India; Cambodia.

†*Circobotys marginalis* Hmpsn. Ill. Het. viii. p. 133, pl. 155. f. 9 (♀).

(31)†Crocidophora acutangulalis Swinh. A. M. N. H. (6) xiv. p. 143. N.E. India.

(32) Crocidophora huronalis Guen. Delt. & Pyr. p. 198. U.S.A.; W. Indies; S. Amer.

†*Samea zinghalis* Wlk. xvii. 355.

†*Phalangiodes serinalis* Wlk. xvii. 468.

Genus 104. Maruca.

Crochiphora Geyer, Hübn. Samml. Exot. Schmett. iv. 4, p. 12 (1832), non descr.

Maruca Wlk. xviii. 540 (1859).

Siriocauta Led. Wien. Ent. Mon. 1863, p. 424.

Palpi porrect and triangularly scaled, the 3rd joint hidden by hair; maxillary palpi very slightly dilated with scales; frons flat and oblique; antennæ slightly longer than fore wing and annulated; legs long, tibiæ with the outer spurs about half the length of inner; abdomen long. Fore wing with vein 3 from angle of cell; 4, 5 closely approximated for a short distance; 7 curved and approximated to 8, 9, to which 10 also is approximated. Hind wing with vein 3 from angle of cell, which is about half the length of wing; 4, 5 closely approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 104.

Maruca testulalis, ♂. ½. (From Moths Ind. vol. iv.)

Type. (1) Maruca testulalis Geyer, Hübn. Samml. Exot. Schmett. iv. 4, p. 12, ff. 629, 630. Tropical zone.

Hydrocampa aquatilis Boisd., Guér.-Mén. Icon. Règne Anim. pl. 90. f. 9.

(2) Maruca amboinalis Feld. Reis. Nov. pl. 135. f. 24. India; Burma; Borneo; Amboina.

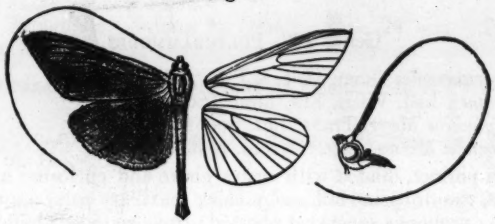
Siriocauta similialis Snell. Midd.-Sum., iv. Lep. p. 72.

Genus 105. Adeloïdes.

Adeloïdes Warr. A. M. N. H. (6) ix. p. 299 (1892).

Palpi porrect, rather long and triangularly scaled, the 3rd joint hidden by hair; maxillary palpi dilated with scales; frons rounded; antennæ minutely ciliated, at least one and a half times length of fore wing, the basal joint dilated in both sexes; the vertex of head clothed with rough hair; abdomen of male extending far beyond the anal angle of hind wing, the claspers large and covered by the large anal tuft; tibiæ with the outer spurs minute. Fore wing of male narrow and produced at apex; vein 3 from well before angle of cell; 4, 5 from angle; 7 nearly straight and well separated from 8, 9. Hind wing of male very ample; the cell short; vein 3 from angle; 4, 5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 105.



Adeloïdes cinerealis, ♂. ½. (From Moths Ind. vol. iv.)

Type. (1)†Adeloïdes cinerealis Moore, P. Z. S. 1867, p. 94. Sikhim.

(2)†Adeloïdes glaucoptera Hmpsn. Moths Ind. iv. p. 395. Bhutan.

Genus 106. Tetridia.

Tetridia Warr. A. M. N. H. (6) vi. p. 477 (1890).

Palpi porrect and triangularly scaled, the 3rd joint hidden by

Fig. 106.

Tetridia caletoralis, ♂. ½. (From Moths Ind. vol. iv.)

hair; maxillary palpi dilated with scales; frons flat and oblique;

antennæ of male minutely ciliated and considerably longer than fore wing, of female about the length of fore wing; fore and mid tibiæ of male fringed with hair on outer side, the thorax with tufts of hair below near mid legs; abdomen of male with the anal tuft long. Fore wing with the apex produced, the outer margin oblique; vein 3 from near angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9, to which 10 is approximated. Hind wing with the cell short, especially in male; vein 3 from angle; 4, 5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8; 6 in male curved downwards.

Type. †Tetridia caletoralis Wlk. xviii. 651. N.E. India: Ceylon; Burma; Malayan subregion.

Botys phœnisalis Wlk. xviii. 684.

† „ *vinacealis* Moore, P. Z. S. 1877, p. 619.

Polythlipta albicaudalis Snell. Tijd. v. Ent. 1880, p. 221, & 1883, pl. 8. f. 7.

Genus 107. Polygrammodes.

Polygrammodes Guen. Delt. & Pyr. p. 318 (1854).
Pachynoa Led. Wien. Ent. Mon. 1863, p. 391.
Aphytoceros Meyr. Trans. Ent. Soc. 1884, p. 320.
Pitacanda Moore, Lep. Ceyl. iii. p. 334 (1887).

Palpi porrect, dilated with scales above and enclosing a hollow in male, the 3rd joint hidden by hair; maxillary palpi minute and filiform; proboscis somewhat aborted; frons rounded; build stout; fore tibiæ and tarsi usually fringed with hair; mid tibiæ fringed with hair; hind tibiæ with a tuft of hair on outer side near base; the spurs rather short. Fore wing produced at apex, the outer margin oblique, the inner margin lobed at middle; vein 1 *a* forming a fork with 1 *b*; 3 from angle of cell; 4, 5 approximated for a short distance; 7 curved and closely approximated to 8, 9, to which 10 also is approximated. Hind wing with vein 3 from angle of cell; 4, 5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing strongly with 8.

Fig. 107.

Polygrammodes thoosalis, ♂. ½. (From Moths Ind. vol. iv.)

Sect. I. Antennæ of male bipectinate, with long branches.

(1)*Polygrammodes cærulalis Wlk. xix. 1000. Borneo.

SECT. II. (*Pachynoa*). Antennæ of male minutely serrate on upper side, pectinate on lower side.

A. Antennæ of male with the branches on lower side long.

(2)†POLYGRAMMODES PURPURALIS Wlk. xxxiv. 1482. Java.
Pachynoa ledereri Snell. Tijd. v. Ent. xxxv. p. 164, pl. x. f. 8.

(3)*POLYGRAMMODES HYALOSTICTA, n. sp.

♂. Head, thorax, and abdomen purplish red-brown, the last ochreous towards extremity; palpi at base, pectus, and ventral surface of abdomen white. Fore wing bright yellow; the basal third purplish red, conjoined on costal area to a triangular patch extending to apex and down to vein 1 and edged with red; a quadrate hyaline spot in end of cell; a subterminal series of red points. Hind wing bright yellow, the basal third purplish red with oblique outer edge; an irregularly waved postmedial red line between veins 7 and 2, with red point above vein 5; a waved sinuous subterminal red line.

Hab. Bunguram, Natuna Is. (*Hose*). *Exp.* 26 mm. Type in Coll. Rothschild.

(4) POLYGRAMMODES PECTINICORNALIS Guen. Delt. & Pyr. p. 326. N. & W. India.

(5)†POLYGRAMMODES FUSCITALIS Hmpsn. Ill. Het. viii. p. 133, pl. 155. f. 2. S. India.

(6) POLYGRAMMODES HYPSALIS Hmpsn. Moths Ind. iv. p. 398. Sikhim.

B. Antennæ of male with the branches on lower side short.

a. Hind tibiæ of male strongly dilated before middle and at extremity, the terminal spurs absent; fore wing with a large shallow fovea on vein 1 above the lobe of inner margin; hind wing with a vesicular lobe clothed with hair on inner margin.

(7)†POLYGRAMMODES THOOSALIS Wlk. xviii. p. 737; Moore, P. Z. S. 1877, pl. 60. f. 16. N.E. India; Malayan subregion.
Pachynoa walkeri Led. Wien. Ent. Mon. 1863, p. 391, pl. 13. f. 2.

b. Hind tibiæ of male and wings normal.

(8) POLYGRAMMODES SABELIALIS Guen. Delt. & Pyr. p. 326.
†*Botys elycealis* Wlk. xix. 995. E. Africa; India; Burma.
Pachynoa obstructalis Wlk. xxxiv. 148. Andamans; Amoy.

(9)†POLYGRAMMODES LIMITALIS, n. sp.

♂. Differs from *purpuralis* in its small size; the basal red area of both wings small; the discal expansion of the costal red fascia on fore wing small.

Hab. Sarawak, Borneo (*Wallace*). *Exp.* 30 mm.

(10) POLYGRAMMODES SPILOSOMOIDES Moore, Lep. Ceyl. iii. p. 324, pl. 183. f. 10. India; Ceylon.

(11)†POLYGRAMMODES MINEUSALIS Wlk. xvii. 481 (♀). Burma.

(12)†POLYGRAMMODES EFFUSALIS Wlk. xxxiv. 1445. Java.

SECT. III. Antennæ of male serrate and fasciculate.

(13)†POLYGRAMMODES NONAGRIALIS, n. sp.

♂. Pale ochreous grey-brown; palpi fuscous at sides. Fore wing with fuscous discoidal lunule; traces of curved postmedial series of fuscous points in the interspaces, and of fuscous subterminal streaks towards apex. Hind wing whitish, tinged with brownish towards termen.

Hab. Callao, Peru (*J. J. Walker*). *Exp.* 40 mm.

SECT. IV. (*Aphytoceros*). Antennæ of male ciliated.

A. Tibiæ fringed with hair.

(14)†POLYGRAMMODES SPISSALIS Guen. Delt. & Pyr. p. 327. Assam; Java.

(15)†POLYGRAMMODES GROSSALIS Guen. Delt. & Pyr. p. 327. Java.

B. Tibiæ smoothly scaled.

(16)†POLYGRAMMODES PHYLLOPHILA Butl. A. M. N. H. (5) ii. p. 296 (1878). Madagascar.

(17) POLYGRAMMODES TAPSUSALIS Wlk. xviii. 697. Borneo; Pulo Laut.

(18) POLYGRAMMODES PONDERALIS Guen. Delt. & Pyr. p. 328, pl. 8. f. 10. Brazil.

Botys humeralis Wlk. xxxiv. 1397.

(19) POLYGRAMMODES HERCULES Feld. Reis. Nov. pl. 135. f. 49. Centr. Amer.

(20)*POLYGRAMMODES RUFINALIS, n. sp.

♂. Brown with a pinkish tinge; palpi below, pectus, and ventral surface of abdomen whitish. Fore wing with indistinct dark antemedial line, oblique from costa to below median nervure, where it is angled; a small quadrate hyaline spot in end of cell and wedge-shaped spot beyond it; a dentate postmedial line bent outwards between veins 5 and 2, the area in its sinus and between it and the dentate subterminal line brick-red. Hind wing with quadrate hyaline spot in cell and wedge-shaped spot beyond it; the area from middle to terminal band brick-red; the postmedial line bent outwards and strongly dentate between veins 5 and 2.

Underside largely suffused with white; prominent black spots in cell and on discocellulars.

Hab. Venezuela, Palma Sol. *Exp.* 46 mm. Type in Coll. Rothschild.

(21)†POLYGRAMMODES LUCUSALIS Wlk. xviii. 722. Australia.
Botys histrionalis Led. Wien. Ent. Mon. 1863, p. 371, pl. 9. f. 13.

(22)*POLYGRAMMODES SANGUINALIS Druce, Biol. Centr.-Am., Het. ii. p. 218, pl. 61. f. 7. Mexico; Centr. Amer.

(23) POLYGRAMMODES OSTREALIS Guen. Delt. & Pyr. p. 327. W. Indies; S. Amer.

(24) POLYGRAMMODES HIRTALIS Guen. Delt & Pyr. p. 344.
†*Botys lybialis* Wlk. xviii. 624. Florida; C. & S. Amer.
† „ *amatalis* Wlk. xviii. 625.
†*Botis capitalis* Grote, Bull. U. S. Geol. Surv. vi. p. 272.

Type. (25)*POLYGRAMMODES RUNICALIS Guen. Delt. & Pyr. p. 318, pl. 5. f. 7. Brazil.

(26)*POLYGRAMMODES SENAHUENSIS Druce, Biol. Centr.-Am., Het. ii. p. 214, pl. 61. f. 1, Guatemala.

(27)†POLYGRAMMODES FARINALIS, n. sp.

White slightly suffused with pale fuscous brown. Fore wing with brown costal fascia; an obliquely sinuous antemedial line; a spot in cell; minutely waved and slightly curved medial and postmedial lines, the latter slightly bent outwards at vein 5; a crenulate submarginal line. Hind wing pure white, with traces of curved postmedial line and marginal series of specks; underside with prominent postmedial line and marginal band on costal half.

Hab. Brazil (*Jones*). *Exp.* 38 mm.

Auctorum.

Pachynoa crœsus Druce, Biol. Centr.-Am., Het. ii. p. 219, pl. 61. f. 8. Guatemala.

Genus 108. PARBATTIA.

Parbattia Moore, Lep. Atk. p. 225 (1887).

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair;

Fig. 108.

Parbattia vialis, ♂. ½. (From Moths Ind. vol. iv.)

maxillary palpi filiform; frons rounded; antennæ of male minutely

ciliated; tibiæ with the outer spurs about two-thirds length of inner. Fore wing with the apex produced, the outer margin oblique; vein 3 from near angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9; male with a fovea below the cell at origin of vein 2. Hind wing with the costa lobed and fringed with hair near base; the cell extremely short and the discocellulars produced for a long way along median nervure so that veins 3, 4, 5 appear to be stalked; 6, 7 from upper angle, 7 anastomosing strongly with 8.

Type. PARBATTIA VIALIS Moore, Lep. Atk. p. 225, pl. 7. f. 30. N.E. India.

Genus 109. DISCOTHYRIS.

Discothyris Warr. A. M. N. H. (6) xvi. p. 473 (1895).

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi filiform; frons rounded; antennæ of male ciliated; tibiæ with the outer spurs about half the length of inner. Fore wing with the costa arched towards apex, which is acute; the outer margin angled at vein 4; vein 3 from close to angle of cell; 4, 5 from angle; 7 curved and approximated for a short distance to 8, 9, to which 10 also is approximated. Hind wing with the outer margin produced to a point at vein 6 and excurved at middle; vein 3 from angle of cell; 4, 5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8; a large tuft of hair on median nervure at lower angle of cell.

Fig. 109.

Discothyris ferruginata, ♂. ½. (From Moths Ind. vol. iv.)

Type. (1)†DISCOTHYRIS FERRUGINATA Moore, Lep. Atk. p. 209. Sikhim.

(2)*DISCOTHYRIS VESTIGIALIS Snell. Trans. Ent. Soc. 1890, p. 628. Sikhim.

(3) DISCOTHYRIS MEGALOPHALIS, n. sp.

♂. Dull ferruginous brown; palpi white below at base. Fore wing with discocellular black lunule; a postmedial series of black specks, most prominent towards costa and forming a larger spot on costa, excurved from below costa to vein 4, then inwardly oblique. Hind wing with the tuft very large, extending along vein 2 and blackish, a postmedial sinuous black line somewhat maculate between veins 5 and 2; both wings with black line at base of cilia.

Hab. Khásis. *Exp.* 18 mm. Type in Coll. Rothschild.

Genus 110. Nomophila.

Nomophila Hübn. Verz. p. 368 (1827).

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi filiform; frons rounded; antennæ of male with long cilia; tibiæ with the outer spurs about half the length of inner; abdomen of male with lateral tufts on the terminal segments. Fore wing long and narrow; the apex rounded; vein 3 from well before angle of cell; 4, 5 from angle; 7 curved and approximated to 8, 9. Hind wing ample; veins 4, 5 closely approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 110.

Nomophila noctuella, ♂. ½. (From Moths Ind. vol. iv.)

Type. (1) Nomophila noctuella Schiff. Wien. Verz. p. 136. Universally distributed.
Pyralis hybridalis Hübn. Pyr. ff. 114, 184.
†*Nephopteryx indistinctalis* Wlk. xxvii. 59.
Botys helvolalis Maasen, Stübel's Reise, p. 170, f. 26.

(2)†Nomophila astigmalis, n. sp.

Grey-brown; palpi white at base. Fore wing with the costal area suffused with fuscous; the antemedial line represented by obscure points; a dark point in cell and slight discoidal lunule; dark points on vein 2 near origin and middle of vein 1; the postmedial line represented by dark points on the veins excurved below costa. Hind wing pale yellowish.
Hab. Mexico, Orizaba (*Schaus*). *Exp.* 26 mm.

Auctorum.

Nomophila triticalis Berg, Deutsche Ent. Zeit. 1875, p. 155. Argentina.
„ *moluccana* Pag. J.B. Nass. Ver. xxxvii. p. 269. Amboina.

Genus 111. Pachyzancla.

Pachyzancla Meyr. Trans. Ent. Soc. 1884, p. 315.
Acharana Moore, Lep. Ceyl. iii. p. 285 (1885).
Rhectocraspeda Warr. A. M. N. H. (6) ix. p. 439 (1892).
Ptiloptila Swinh. A. M. N. H. (6) xiv. p. 142 (1894).
Pantaxocome Warr. A. M. N. H. (6) xviii. p. 173 (1896).

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi filiform; frons rounded; antennæ of male ciliated;

tibiæ with the outer spurs half the length of inner. Fore wing with veins 3, 4, 5 from angle of cell; 7 curved and approximated to 8, 9, to which 10 also is approximated. Hind wing with vein 3 from angle of cell; 4, 5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 111.

Pachyzancla licarsisalis, ♂. ½. (From Moths Ind. vol. iv.)

Sect. I. Mid femora of male immensely dilated and clothed with large smooth scales on inner side.

A. Fore wing of male with the basal half of costa below fringed with long thick black hair; fore legs clothed with rough hair near the femoro-tibial joint.

(1)†Pachyzancla licarsisalis Wlk. xviii. 686. Syria; Oriental and Australian regions.
†*Botys pharaxalis* Wlk. xviii. 725.
† „ *immundalis* Wlk. xxxiv. 1448.
Entephria fumidalis Wlk. xxxiv. 1486.
Botys serotinalis Joannis, Ann. Soc. Ent. Fr. (6) viii. p. 272, pl. 6. f. 2.

B. (*Acharana*). Fore wing of male with no fringe of hair on underside of costa; fore legs normal.

(2) Pachyzancla phæopteralis Guen. Delt. & Pyr. p. 349. The Tropical zone.
Botys vecordalis Guen. Delt. & Pyr. p. 348.
† „ *vestalis* Wlk. xviii. 579.
† „ *otreusalis* Wlk. xviii. 637; Moore, Lep. Ceyl. iii. pl. 180. f. 11.
† „ *triarialis* Wlk. xviii. 639.
† „ *neloalis* Wlk. xviii. 643.
† „ *abstrusalis* Wlk. xviii. 663.
„ *additalis* Wlk. Trans. Ent. Soc. (3) i. 126.
„ *cellatalis* Wlk. xxxiv. 1400.
„ *inhonestalis* Wlk. xxxiv. 1433.
„ *plebejalis* Led. Wien. Ent. Mon. 1873, p. 373.
†*Acharana descripta* Warr. A. M. N. H. (6) ix. p. 436.

Sect. II. Mid tibiæ of male dilated, widest at middle and deeply grooved in front.

(3)†Pachyzancla olivescens Warr. A. M. N. H. (6) ix. p. 436. Ecuador.

SECT. III. (*Pantœocome*). Hind femora of male fringed with long thick hair, the tibiæ immensely dilated and thickly fringed with large flattened scales.

(4) PACHYZANCLA DILATATIPES Wlk. xxxiv. 1419. Sumbawa; Mysol; Tenimber.
Pantœocome deformis Warr. A. M. N. H. (6) xviii. p. 173.

SECT. IV. Legs of male normal.

A. Both wings of male with the basal half clothed above with thick woolly hair; fore wing with thick flocculent whitish hair on basal half of costa; patagia fringed with long curved hair and extending beyond metathorax.

(5)†PACHYZANCLA SEMILANIATA Hmpsn. A. M. N. H. (6) xvi. p. 342. W. Indies.

B. Fore wing of male with the costa fringed below with long black hair at base.

(6)†PACHYZANCLA NIGRICORNALIS Swinh. A. M. N. H. (6) xiv. p. 142. Assam.

C. Fore wing of male with a fovea in base of cell, covered on underside by a fan of large scales from subcostal nervure, and the nervures distorted.

(7)†PACHYZANCLA DESMIOIDES, n. sp.

Purplish black; palpi below, pectus, legs, and ventral surface of abdomen white; male with the genital tufts white. Fore wing with irregular white foveal spot in cell, a small round or bar-shaped spot in end of cell; a band beyond the cell between veins 3 and 7, expanding and dentate between veins 3 and 5; cilia white above tornus. Hind wing with transverse white spot below middle of cell; a band beyond the cell between veins 3 and 7, expanding and dentate between veins 3 and 5.

One female has the white markings considerably reduced.

Hab. Fergusson I., N. Guinea (*Meek*). *Exp.* 30 mm.

D. (*Rhectocraspeda*). Hind wing of male with the inner area clothed with long hair, the anal angle lobed and the membrane contorted.

(8)†PACHYZANCLA PERIUSALIS Wlk. xviii. 664. U.S.A.; Brazil.

E. Hind wing of male with the inner margin fringed with long hair; a tuft of very long hair near base.

(9)†PACHYZANCLA MALEDICTA Warr. A. M. N. H. (6) ix. p. 435. Sumbawa; Pitcairn Island.

F. Wings of male normal.

a. Patagia of male fringed with long hair extending far beyond metathorax.

a'. Antennæ of male with small scale-teeth on base of shaft above.

(10)†PACHYZANCLA PACHYCERA, n. sp.

Fuscous brown; palpi at base, pectus, and ventral surface of abdomen white, the second segment of abdomen with subdorsal black points. Fore wing with the costa purplish fuscous; an antemedial black line incurved to costa; a point in cell and discoidal lunule; the postmedial line oblique from costa to vein 5, dentate to vein 2, then retracted to below angle of cell. Hind wing with discoidal point; the postmedial line bent outwards and dentate between veins 5 and 2; both wings with dark terminal line; cilia pale, with a fuscous line through them.

Hab. Orizaba, Mexico (*Schaus*). *Exp.* 32 mm.

b'. Antennæ of male with a curved tuft of hair on basal joint, the base of shaft excised.

(11)†PACHYZANCLA COPTOBASALIS Hmpsn. Journ. Bomb. Nat. Hist. Soc. ined. Sikhim.

c'. Antennæ of male normal.

Type. (12)†PACHYZANCLA STULTALIS Wlk. xviii. 669. Oriental region
Botys jasiusalis Wlk. xviii. 708. to Celebes & Australia.
† „ *basistrigalis* Wlk. xxxiv. 1433.

b. Patagia of male not extending beyond metathorax.

(13)†PACHYZANCLA BIPUNCTALIS Fabr. Ent. Syst. iii. 2, p. 227. Neotropical, Nearctic, Ethiopian, &
†*Pachyzancla ægrotalis* Zell. Lep. Caffr. p. 39. Oriental regions.
†*Botys mutualis* Zell. Lep. Caffr. p. 40.
„ *veminalis* Guen. Delt. & Pyr. p. 348.
„ *detritalis* Guen. Delt. & Pyr. p. 347, pl. 4. f. 10.
† „ *lycialis* Wlk. xviii. 572.
† „ *philealis* Wlk. xviii. 596.
† „ *admensalis* Wlk. xviii. 652; Hmpsn. Ill. Het. ix. pl. 173. f. 10.
† „ *basalis* Wlk. xxxiv. 1404.
† „ *apertalis* Wlk. xxxiv. 1450.
† „ *repetitalis* Grote, New Check-List, p. 53.
†*Acharana rudis* Warr. A. M. N. H. (6) ix. p. 435.
† „ *elongalis* Warr. A. M. N. H. (6) ix. p. 437.
† „ *fuscescens* Warr. A. M. N. H. (6) ix. p. 437.
† „ *simplex* Warr. A. M. N. H. (6) ix. p. 436.
† „ *subalbescens* Swinh. A. M. N. H. (6) xiv. p. 147.
„ *honesialis* Warr. A. M. N. H. (6) xvii. p. 97.
Hedylepta ochrifuscalis Warr. A. M. N. H. (6) xvii. p. 98.
Acharana subœnescens Warr. A. M. N. H. (6) xviii. p. 113.

(14)†Pachyzancla acyptera, n. sp.

♂. Grey with a slight olive tinge; head and tegulæ tinged with fuscous; palpi white below. Fore wing with the apex produced and acute, the outer margin excised; the base of costa blackish; an indistinct obliquely curved antemedial line; traces of a point in cell and a black discoidal spot; the postmedial line slightly curved from costa to vein 2, then retracted to below end of cell. Hind wing with discoidal spot; a dark postmedial line excurved between veins 5 and 2, then slightly retracted; both wings with fine dark terminal line.

Hab. Orizaba, Mexico (*Schaus*). *Exp.* 24 mm.

(15)†Pachyzancla innotalis, n. sp.

Cupreous fuscous; palpi white at base; pectus and ventral surface of abdomen whitish. Fore wing with very faint traces of the ante- and postmedial lines; indistinct dark points at middle of cell and on discocellulars. Hind wing with indistinct dark discoidal point and faint traces of the postmedial line.

Hab. Venezuela, Aroa. *Exp.*, ♂ 22, ♀ 24 mm.

(16) Pachyzancla cynaralis Wlk. xviii. 672. India; Ceylon.
†*Hapalia marginalis* Moore, Lep. Ceyl. iii. p. 538, pl. 182. f. 13.

(17)†Pachyzancla latifuscalis Hmpsn. Journ. Bomb. Nat. Hist. Soc. ined. Sikhim.

(18)†Pachyzancla hipponalis Wlk. xvii. 374. Formosa;
†*Botys pigresalis* Wlk. xviii. 724. Australia.

(19) Pachyzancla marginalis Warr. A. M. N. H. (6) xviii. p. 115. Sikhim; Khásis.
Goniorhynchus obliquistriga Warr. A. M. N. H. (6) xviii. p. 115.

(20)†Pachyzancla subdentalis Swinh. A. M. N. H. (6) xiv. p. 147. Assam.

(21)†Pachyzancla minoralis Warr. A. M. N. H. (6) ix. p. 435. W. Africa.

(22)†Pachyzancla ustulalis Hmpsn. Moths Ind. iv. p. 403. Ceylon.

(23)*Pachyzancla rufescentalis Hmpsn. Moths Ind. iv. p. 403. Burma.

(24)†Pachyzancla intensalis Swinh. A. M. N. H. (6) xiv. p. 143. Assam.
Ebulea ochripunctalis Warr. A. M. N. H. (6) xviii. p. 111.

(25)*Pachyzancla calistalis Hmpsn. Moths Ind. iv. p. 404. Assam.

Genus 112. Rhectosomia.

Rhectosomia Led. Wien. Ent. Mon. 1863, p. 414.

Palpi porrect, short, triangularly scaled, the 3rd joint concealed

maxillary palpi filiform; frons with a rounded prominence; antennæ of female almost simple; legs long and slender. Fore wing with the costa arched towards apex, which is produced and acute; the outer margin excised below apex, then excurved; veins 3, 4, 5 from angle of cell; 7 straight and well separated from 8, 9, to which 10 is closely approximated. Hind wing with the cell half the length of wing; vein 3 from angle; 4, 5 approximated for some distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 112.

Rhectosomia argentipunctalis, ♂. ½.

Type. (1)*Rhectosomia multifarialis Led. Wien. Ent. Mon. 1863, p. 414, pl. 15. f. 7. Mexico; Costa Rica; Venezuela.

(2)*Rhectosomia argentipunctalis Druce, Biol. Centr.-Am., Het. ii. p. 264, pl. 62. ff. 28, 29. Mexico; Guatemala.

Genus 113. Loxoneptera.

Loxoneptera Hmpsn. Moths Ind. iv. p. 405 (1896).

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi filiform; frons produced to a flattened plate with rounded edge; antennæ of male minutely ciliated; tibiæ with the outer spurs minute; mid tibiæ of male dilated with a fold containing a tuft of long hair; abdomen of male with very large

Fig. 113.

Loxoneptera carnealis, ♂. ½. (From Moths Ind. vol. iv.)

paired lateral tufts from just beyond middle. Fore wing of male with fringe of long hair on base of inner margin, which is excised towards outer angle and bears a curved tuft of hair; vein 3 before angle of cell; 4, 5 from angle; 7 curved and approximated to 8, 9, to which 10 also is approximated. Hind wing of male with

fringe of hair on median nervure towards angle of cell; a small tuft below vein 2 and a fringe on vein 1 *c*; vein 3 from before angle of cell; 4, 5 somewhat approximated for a short distance; 6, 7 from upper angle.

Type. LOXONEPTERA CARNEALIS Hmpsn. Moths Ind. iv. p. 406. N.E. India.

Genus 114. PROCEDEMA.

Procedema Hmpsn. Moths Ind. iv. p. 406 (1896).

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi filiform; frons with a rounded prominence, antennæ thickened and flattened; tibiæ with the outer spurs half the length of inner; male with the claspers long and exserted. Fore wing rather narrow, the apex rounded; vein 3 from before angle of cell; 4, 5 from angle; 7 curved and approximated to 8, 9. Hind wing with veins 4, 5 approximated for a short distance; 6, 7 stalked, 7 anastomosing with 8.

Fig. 114.

Procedema inscisalis, ♂. ½. (From Moths Ind. vol. iv.)

Type. (1)†PROCEDEMA INSCISALIS Wlk. xxxiv. 1410; Moore, Lep. Ceyl. iii. pl. 181. f. 1. India; Ceylon; Malayan subregion to Australia.

(2)†PROCEDEMA NIGROLINEALIS Warr. A. M. N. H. (6) ix. p. 390. Argentina.

Genus 115. PHLYCTÆNODES.

Emmelia Hübn. Samml. Exot. Schmett. v. 8, p. 409 (1824), non. descr.
Loxostege Hübn. Verz. p. 352 (1827), non. descr.
Phlyctænodes Guen. Delt. & Pyr. p. 173 (1856).
Spilodes Guen. Delt. & Pyr. p. 379.
Dosara Wlk. xix. 828 (1859).
Ephelis Led. Wien. Ent. Mon. 1863, p. 356.
Eurycreon Led. Wien. Ent. Mon. 1863, p. 376.
Metallarcha Meyr. Trans. Ent. Soc. 1884, p. 331.
Proternia Meyr. Trans. Ent. Soc. 1884, p. 317.
Proteræca Meyr. Trans. Ent. Soc. 1884, p. 335.
Tritæa Meyr. Trans. Ent. Soc. 1884, p. 341.
Blepharucha Warr. A. M. N. H. (6) ix. p. 177 (1892).
Euctenospila Warr. A. M. N. H. (6) ix. p. 177.

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair;

maxillary palpi filiform: frons with a pointed conical prominence; antennæ of male almost simple; tibiæ smooth. Fore wing with vein 3 from near angle of cell; 7 straight and well separated from 8, 9. Hind wing with vein 3 from close to angle of cell; 4, 5 from angle and more or less approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 115.

Phlyctænodes massalis, ♂. ½. (From Moths Ind. vol. iv.)

SECT. I. Hind tibiæ of male with the outer medial spur about one-sixth length of inner.

(1) PHLYCTÆNODES PALEALIS Schiff. Wien. Verz. p. 123. Europe; Madeira; N. Africa; Japan;
Phalæna flaveolata Rott. Naturf. xi. p. 80. China; N. India.
Pyralis selenalis Hübn. Samml. Eur. Schmett., Pyr. f. 177.
†*Botys anaxisalis* Wlk. xviii. 658.
Spilodes algiralis Allard, Ann. Soc. Ent. Fr. 1867, p. 321, pl. 6. f. 11 (var.).

(2)†PHLYCTÆNODES DASCONALIS Wlk. xviii. 773. U.S.A.

(3) PHLYCTÆNODES COLORADENSIS Grote & Rob. Tr. Am. Ent. Soc. i. p. 25, pl. 2. f. 18. U.S.A.
Botys pergilvalis Hulst, Tr. Am. Ent. Soc. xiii. p. 151.

(4)†PHLYCTÆNODES OBLITERALIS Wlk. xxxiv. 1892. U.S.A.
Botys marculenta Grote & Rob. Tr. Am. Ent. Soc. i. p. 23, pl. 2. f. 21.

(5) PHLYCTÆNODES MANCALIS Led. Wien. Ent. Mon. 1863, p. 371, pl. 9. f. 4. U.S.A.

(6)*PHLYCTÆNODES CYRALIS Druce, Biol. Centr.-Am., Het. ii. p. 204, pl. 60. f. 15. U.S.A.; Mexico.

(7) PHLYCTÆNODES VERTICALIS Linn. Syst. Nat. x. no. 335. Europe; Japan; Afghanistan; N.W. Himalayas.
Pyralis limbalis Schrank, Faun. Boica, ii. 2. 64.
Botys cinctalis Tr. Schmett. Eur. vii. p. 97.
„ *lavalis* H.-S. Eur. Schmett. p. 37.
Var. *nigricilialis* Rag. Bull. Soc. Ent. Fr. 1895, p. xcviii.

(8) PHLYCTÆNODES CHORTALIS Grote, Bull. Buff. Soc. i. p. 89, pl. 2. f. 13. U.S.A.

(9)†Phlyctænodes crocalis Hmpsn. Ill. Het. viii. p. 131, pl. 154. f. 7. S. India; Ceylon.

(10)†Phlyctænodes perbonalis Swinh. Trans. Ent. Soc. 1890, p. 272, pl. 8. f. 17. Burma.

(11)†Phlyctænodes brevivittalis Hmpsn. Moths Ind. iv. p. 409. Assam.

(12) Phlyctænodes decoloralis Warr. A. M. N. H. (6) xviii. p. 111. Assam.

(13)†Phlyctænodes flavifimbrialis Warr. A. M. N. H. (6) ix. p. 174. U.S.A.

Sect. II. Hind tibiæ of male with the outer spurs about half the length of inner.

A. (*Euctenospila*). Antennæ of male bipectinate.

(14)†Phlyctænodes castalis Warr. A. M. N. H. (6) ix. p. 177. Abyssinia.

B. (*Proternia*). Antennæ of male sinuate and bent at two-thirds, with a row of projecting scales in the bend below.

(15) Phlyctænodes philocapna Meyr. Trans. Ent. Soc. 1884, p. 317. N. Zealand.

C. Antennæ of male ciliated.

(16) Phlyctænodes sulphuralis Hübn. Samml. Eur. Schmett., Pyr. ff. 166, 167. S. & E. Europe.

(17)*Phlyctænodes inornatalis Leech, Entom. 1889, p. 68, pl. 3. f. 13. Japan.

(18) Phlyctænodes turbidalis Tr. Schmett. Eur. vii. p. 119. S. Europe; Armenia.
Scopula flagellalis Dup. Lep. Fr. vii. p. 370, pl. 236. ff. 1, 2.
Pyralis gilvalis Hübn. Samml. Eur. Schmett., Pyr. f. 154.

(19) Phlyctænodes virescalis Guen. Delt. & Pyr. p. 383. C. Europe.
Scopula clathralis Dup. Lép. Fr. viii. pl. 236. ff. 8, 9.

(20) Phlyctænodes clathralis Hübn. Samml. Eur. Schmett., Pyr. f. 168. S. Europe: Armenia.
Eurycreon comptalis Led. Verh. z.-b. Ver. 1855, p. 552.
Spilodes tesselalis Guen. Delt. & Pyr. p. 383 (var.).
„ *granatalis* Staud. S. E. Z. 1859, p. 222.

(21) Phlyctænodes æruginalis Hübn. Samml. Eur. Schmett., Pyr. f. 133. S. Europe
Pyralis olivalis Hübn. Samml. Eur. Schmett., Pyr. f. 162.

(22) PHLYCTÆNODES COMPTALIS Frr. vi. p. 68, pl. 521. f. 4.
Mediterranean subregion.

(23) PHLYCTÆNODES MUCOSALIS H.-S. iv. p. 23. ff. 14, 15.
S.E. Europe; W. Asia.

(24)†PHLYCTÆNODES SIMPLALIS Swinh. P. Z. S. 1889, p. 421.
N.W. India.

(25)†PHLYCTÆNODES HELVIALIS Wlk. xviii. 772. U.S.A.
†*Botys thycesalis* Wlk. xix. 981.
† „ *apertalis* Wlk. xxxiv. 1393.
„ *citrina* Grote & Rob. Tr. Am. Ent. Soc. i. p. 23, pl. 2. f. 20.

(26) PHLYCTÆNODES NUDALIS Hübn. Samml. Eur. Schmett., Pyr. f. 90. S. Europe; W. Africa; Syria; Aden;
Pyralis interpunctalis Hübn. Samml. Eur. Schmett., Pyr. f. 128. India; Ceylon.
Botys unipunctalis Dup. Lép. Fr. viii. p. 166, pl. 221. f. 5.
„ *bipunctalis*, Dup. Lép. Fr. viii. p. 167, pl. 221. f. 6.
† „ *pauciferalis* Wlk. xxxiv. 1415.

(27)†PHLYCTÆNODES BIFIDALIS Fabr. Ent. Syst. iii. 2, p. 232.
W. Indies; S. America.
Phlyctænodes inornatalis Wlk. xxxiv. 1456.
Eurycreon evanidalis Berg, Bol. Ac. Cordova, i. p. 163.
„ *obsoletalis* Berg, Bol. Ac. Cordova, i. p. 165 (var.).
Botys orbitalis Feld. Reis. Nov. pl. 134. f. 32.

(28)†PHLYCTÆNODES FERRUGINEA Warr. A. M. N. H. (6) ix. p. 179 (1892). Argentina; Peru.

(29)†PHLYCTÆNODES FULVALIS Warr. A. M. N. H. (6) ix. p. 301.
S. Africa.

(30)†PHLYCTÆNODES UMBROSALIS Warr. A. M. N. H. (6) ix. p. 301.
China.

(31) PHLYCTÆNODES SIMILALIS Guen. Delt. & Pyr. p. 405.
N. & S. America; W. Indies.
Nymphula rantalis Guen. Delt. & Pyr. p. 405.
†*Ebulea murcialis* Wlk. xviii. 746.
†*Scopula crinisalis* Wlk. xviii. 798.
†*Botys siriusalis* Wlk. xviii. 563.
† „ *licealis* Wlk. xviii. 563.
†*Scopula nestusalis* Wlk. xviii. 784.
† „ *thoonalis* Wlk. xviii. 785.
† „ *diotimealis* Wlk. xviii. 785.
†*Nephopteryx intractella* Wlk. xxvii. 55.
Botys posticata Grote & Rob. Trans. Am. Ent. Soc. i. p. 22, pl. 2. f. 25.
†*Eurycreon communis* Grote Can. Ent. ix. p. 105.
„ *occidentalis* Pack. Ann. N. Y. Lyc. x. p. 260.

(32)†PHLYCTÆNODES PROTEALIS Warr. A. M. N. H. (6) ix. p. 178 (1892). Peru.

(33)†PHLYCTÆNODES NUBILALIS Hmpsn. Ill. Het. viii. p. 132, pl. 154. f. 12. S. India.

(34)*PHLYCTÆNODES VESPERTILIO Warr. A. M. N. H. (6) xviii. p. 171. Assam.

(35) PHLYCTÆNODES AFFINITALIS Led. Wien. Ent. Mon. 1863, p. 475, pl. 12. f. 4. Australia.
†*Scopula ustalis* Wlk. xxxiv. 1477.
† „ *turbidalis* Wlk. xxxiv. 1477.
†*Nymphula sordida* Butl. Trans. Ent. Soc. 1886, p. 432.

(36) PHLYCTÆNODES STICTICALIS Linn. Faun. Suec. 1354. U.S.A.; *Pyralis fuscalis* Hübn. Pyr. f. 45. Europe; Beloochistan.
„ *tetragonalis* Haw. Lep. Brit. p. 385.
„ *lupulina* Cl. Icon. pl. ix. f. 4.

(37) PHLYCTÆNODES FRUSTALIS Zell. Lep. Caffr. p. 48. S. Africa.
†*Eurycreon leucostictalis* Zell. Verh. z.-b. Ver. 1872, p. 518.

(38)†PHLYCTÆNODES MASSALIS Wlk. xviii. 792. W. Africa;
†*Dosara cœlatalis* Wlk. xix. 829; Hmpsn. India; Ceylon; Ill. Het. ix. pl. 172. f. 22. Australia.

(39)†PHLYCTÆNODES PALMALIS Swinh. P. Z. S. 1884, p. 525, pl. 48. f. 11. Aden; N.W. India.

(40) PHLYCTÆNODES USTRINALIS Christ. Hor. Ent. Ross. xii. 1876, p. 271, pl. 7. f. 45. S. Europe; Tunis; W. Asia;
Metasia excavatalis Rag. Deutsch. Ent. Zeit., Lep. v. p. 294, pl. iii. f. 14. Persia.
„ *emiralis* Oberth. Et. Ent. xii. p. 36, pl. vi. f. 33.

(41)†PHLYCTÆNODES ALBIFASCIALIS Hmpsn. P. Z. S. 1896, p. 276, pl. x. f. 29. Aden.

(42) PHLYCTÆNODES VENUSTALIS Cram. Exot. Schmett. iv. pl. 371. f. I. S. Africa.
Emmelia testula Hübn. Exot. Schmett. v. 8. 409. ff. 817, 818.
†*Botys divulsalis* Zell. Lep. Caffr. p. 47.
†*Scopula jucundalis* Wlk. xxxiv. 1469.

(43) PHLYCTÆNODES PELTALIS Ev. Bull. Mosc. 1842, p. 560, pl. 6. f. 11. Ural & Altai Mts.

(44)†PHLYCTÆNODES ANNAPHILALIS Grote, Can. Ent. xiii. p. 34. U.S.A.

(45)†PHLYCTÆNODES ANARTALIS Grote, Can. Ent. x. p. 27. U.S.A.
Botys lulualis Hulst, Tr. Am. Ent. Soc. xiii. p. 150.

Type. (46) PHLYCTÆNODES PUSTULALIS Hübn. Pyr. ff. 191, 192. S. Europe; Armenia.

(47) PHLYCTÆNODES CRUENTALIS Hübn. Zutr. 29. 361. ff. 721, 722. S. Europe; Armenia; Egypt.
Botys badialis Tr. Schmett. Eur. x. 3. p. 9.
„ *bourjotalis* Dup. Lép. Fr. viii. p. 313, pl. 231. f. 4.

(48)*PHLYCTÆNODES ASOPIALIS Snell. Tijd. v. Ent. xviii. p. 209, pl. 12. f. 3. Trinidad; Amazon.

(49) PHLYCTÆNODES ZAIDE Stoll, pl. 36. f. 6. S. Africa.
Botys cruoralis Zell. Lep. Caffr. p. 51.
†*Scopula dilaceratalis* Wlk. xxxiv. 1469.

(50) PHLYCTÆNODES PLUMBATALIS Zell. Lep. Caffr. p. 51. S. Africa.
Botys plumbofascialis Led. Wien. Ent. Mon. vii. p. 368, pl. 8. f. 7.
†*Scopula ferriscriptalis* Wlk. xxxiv. 1467.

(51)*PHLYCTÆNODES OBLINALIS Feld. Reis. Nov. pl. 134. f. 38. S. Africa.

(52) PHLYCTÆNODES EURYCHRYSA Meyr. Trans. Ent. Soc. 1884, p. 334. Australia.

(53) PHLYCTÆNODES DIPLOCHRYSA Meyr. Trans. Ent. Soc. 1884, p. 332. Australia.

(54) PHLYCTÆNODES CALLIASPIS Meyr. Trans. Ent. Soc. 1884, p. 332. Australia.

(55) PHLYCTÆNODES EPICHRYSA Meyr. Trans. Ent. Soc. 1884, p. 333. Australia.

(56)*PHLYCTÆNODES TETRAPLACA Meyr. Trans. Ent. Soc. 1887, p. 236. Australia.

(57)*PHLYCTÆNODES PSELIOTA Meyr. Trans. Ent. Soc. 1887, p. 237. Australia.

(58)†PHLYCTÆNODES OPHIONALIS Wlk. xvii. 316. U.S.A.

(59) PHLYCTÆNODES SESQUIALTERALIS Zell. Verh. zool.-bot. Ver. Wien, 1873, p. 209, pl. 3. f. 5. U.S.A.

(60)†PHLYCTÆNODES NASONIALIS Zell. Verh. zool.-bot. Ver. Wien, 1873, p. 201, pl. 3. f. 6. U.S.A.

(61) PHLYCTÆNODES VIBICALIS Zell. Verh. zool.-bot. Ver. Wien, 1873, p. 208, pl. 3. f. 4. U.S.A.

Auctorum.

Loxostege baccatalis Hulst, Can. Ent. xxiv. p. 63. U.S.A.
„ *maclurœ* Riley, Insect Life, v. pp. 155, f. 11 & 158. U.S.A.
„ *oberthuralis* Fern. Insect Life, vi. p. 255. U.S.A.
„ *flavalis* Fern. Insect Life, vi. p. 255. U.S.A.
„ *linealis* Fern. Insect Life, vi. p. 255. U.S.A.

Genus 116. Diasemia.

Diasemia Guen. Delt. & Pyr. p. 233 (1854).
Myriostephes Meyr. Trans. Ent. Soc. 1884, p. 327.
Choristostigma Warr. A. M. N. H. (6) ix. p. 440 (1892).

Palpi porrect, triangularly scaled, the 3rd joint hidden; maxillary palpi dilated with scales; frons rounded; antennæ annulated and ciliated, in male minutely serrate; tibiæ with the spurs long and even. Fore wing long and narrow; veins 3, 4, 5 from angle; 7 straight and well separated from 8, 9, to which 10 is approximated. Hind wing with the outer margin excised below apex; the cell short; veins 3, 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing strongly with 8.

Fig. 116.

Diasemia ramburialis, ♂. ½. (From Moths Ind. vol. iv.)

Type. (1) Diasemia litterata Scop. Ent. Carn. p. 229.
Europe; Japan; India; Ceylon.
Phalæna argentalis Fabr. Ent. Syst. p. 419.
†*Isopteryx impulsalis* Wlk. xvii. 404.

(2) Diasemia ramburialis Dup. Lép. Fr. viii. p. 343, pl. 233. f. 6. Universally distributed.
†*Isopteryx melaleucalis* Wlk. xvii. 402.
†*Lineodes leodocusalis* Wlk. xix. 947.
†*Diasemia reconditalis* Wlk. xxxiv. 1325.
† „ *leucophœalis* Wlk. xxxiv. 1326.

(3)†Diasemia accalis Wlk. xix. 1015. China; N.W. Himalayas; Burma; Malayan subregion.
„ *spilonotalis* Snell. Midd.-Sum., iv. Lep. p. 73.

(4)†Diasemia grammalis Doubl. Dieff. N. Zealand, ii. 287. N. Zealand.

(5)†Diasemia janassialis Wlk. xvii. 387. U.S.A.
Botys hariolalis Hulst, Tr. Am. Ent. Soc. xiii. p. 149.

(6)†Diasemia disjectalis Zell. Lep. Caffr. p. 16. S. Africa.

(7) Diasemia matura Meyr. Trans. Ent. Soc. 1884, p. 328. Australia.

(8) Diasemia plumbosignalis Fern. Ent. Am. iv. p. 37. U.S.A.

(9)†Diasemia elegantalis Warr. A. M. N. H. (6) ix. p. 440. U.S.A.

(10)†Diasemia erubescens, n. sp.

♀. Head, thorax, and abdomen red-brown. Fore wing yellow, irrorated with rufous scales, most thickly on costal and outer areas; an indistinct dark sinuous antemedial line; a leaden-coloured annulus in cell; a postmedial slightly curved leaden band with black edges, not reaching costa; a dark point on costa towards apex; a minutely waved subterminal leaden and black line, almost obsolete except between veins 7 and 3. Hind wing whitish, with dark discoidal point; traces of a medial line on inner area; an obscure postmedial line excurved between veins 5 and 2, the area beyond it suffused with rufous; both wings with some terminal dark points.

Hab. Mexico, Orizaba, Jalapa (*Schaus*). *Exp.* 18 mm.

Auctorum.

Diasemia inabsconsalis Möschl. Abh. Senck. Ges. xvi. p. 305. Porto Rico.

Genus 117. Lepidoneura.

Palpi porrect, downcurved, and about twice the length of head; the 3rd joint long; maxillary palpi dilated with scales; frons flat and oblique; antennæ nearly as long as fore wing, and almost simple; legs long and slender; tibiæ slightly fringed with hair, the outer spurs about half the length of inner; male with a large downwardly directed tuft of flattened hair from near origin of fore wing; abdomen long and slender. Fore wing with the costa highly arched towards apex, which is somewhat acute; vein 3 from angle of cell; 4, 5 somewhat approximated for a short distance; 7 curved and approximated to 8, 9, to which 10 also is approximated. Hind wing with the cell about half the length of wing; vein 3 from angle; 4, 5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 117.

Lepidoneura longipalpis, ♂. ½. (From Moths Ind. vol. iv.)

Type. (1)†Lepidoneura longipalpis Swinh. A. M. N. H. (6) xiv. p. 208. Assam.

(2)†Lepidoneura africalis, n. sp.

♀. Ochreous; abdomen with traces of fuscous dorsal bands. Fore wing whitish, with diffused ochreous-brown suffusion on marginal areas; a diffused oblique patch of long dark scales beyond the

cell between veins 8 and 4; an oblique sinuous line of similar scales from vein 5 near termen to middle of inner margin, expanding into a diffused patch below the cell; cilia dark at base. Hind wing yellowish white; termen more ochreous.

Hab. Bathurst, Gambia (*Carter*). *Exp.* 24 mm.

Genus 118. Antigastra.

Antigastra Led. Wien. Ent. Mon. 1863, p. 419.

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi dilated with scales; frons flat and oblique; antennæ nearly as long as the fore wing and minutely ciliated; legs long; fore femora and tibiæ of male fringed with long hair, the outer spurs half the length of inner. Fore wing with the costa arched towards apex, which is acute and produced; veins 3, 4, 5 from angle of cell; 7 straight and well separated from 8, 9. Hind wing with the cell half the length of wing; vein 3 from angle; 4, 5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 118.

Antigastra catalaunalis, ♂. ½. (From Moths Ind. vol. iv.)

Type. (1) Antigastra catalaunalis Dup. Lép. Fr. viii. p. 330, pl. 232. f. 8. Europe; Syria; Aden; E. & W. Africa; India.
Botys venosalis Wlk. xxxiv. 140. Ceylon; Burma; Mexico.

(2)†Antigastra morysalis Wlk. xviii. 641. Natal.
†*Zebronia cranealis* Wlk. xix. 970.

Auctorum.

Antigastra cinnamomalis Saalm. Ber. Senck. Ges. 1879–80, p. 297. Madagascar.

Genus 119. Liopasia.

Liopasia Möschl. Verh. z.-b. Wien, xxxi. p. 426 (1881).
Terastiodes Warr. A. M. N. H. (6) ix. p. 298 (1892).
Dichotis Warr. A. M. N. H. (6) ix. p. 392.

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi strongly dilated with scales; frons oblique; antennæ of male slightly ciliated; build stout; tibiæ smoothly scaled, the outer spurs less than half the length of inner. Fore wing long and narrow, the apex rectangular; the outer margin

excurved below middle; the inner margin excised before outer angle, where there is a scale-tooth; vein 3 from angle of cell; 4, 5 approximated for a short distance; 7 curved and approximated to 8, 9. Hind wing with vein 3 from angle of cell; 4, 5 approximated for some distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 119.

Liopasia ochracealis, ♂. ½.

(1)†Liopasia ochracealis Wlk. xxxiv. 1308. Ecuador; Brazil.
Botys rhodophilalis Maasen, Stübel's Reise, p. 169, pl. ix. f. 20.

(2)†Liopasia dorsalis, n. sp.

♀. Yellowish brown, irrorated with black scales; palpi white below at base; underside of thorax and abdomen white; fore legs banded with brown; abdomen with dorsal yellow patches on first two segments, and a pair of white spots on 3rd. Fore wing with oblique sinuous antemedial dark line; a discocellular speck; a diffused black patch between lower angle of cell and inner margin; a dentate postmedial line angled at vein 5 and with two yellow teeth on it above inner margin; cilia yellow above outer angle. Hind wing semihyaline yellow; the apical area fuscous, narrowing to vein 2.
Hab. Trinidad. *Exp.* 40 mm.

(3) Liopasia teneralis Led. Wien. Ent. Mon. 1863, p. 370, pl. 8. f. 10. N. Amer., Colombia.

Type. (4) Liopasia reliqualis Möschl. Verh. z.-b. Wien, xxxi. p. 426, pl. 18. f. 35. Surinam.

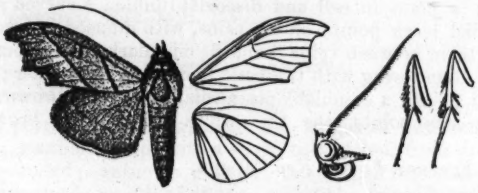
Genus 120. Sparagmia.

Sparagmia Guen. Delt. & Pyr. p. 216 (1854).

Palpi porrect, triangularly scaled and extending about the length of head, the 3rd joint hidden by hair; maxillary palpi strongly dilated with scales; frons flat and oblique; antennæ ciliated; mid tibiæ fringed with hair on outer side; hind tibiæ with tufts of hair on outer side at middle and extremity, the outer spurs about half the length of inner. Fore wing long and narrow, the apex produced and falcate; the outer margin produced to an angle at vein 3; veins 3, 4, 5 from angle of cell; 7 curved and approxi-

mated to 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 shortly stalked, 7 anastomosing with 8.

Fig. 120.



Sparagmia gigantalis, ♂. ½.

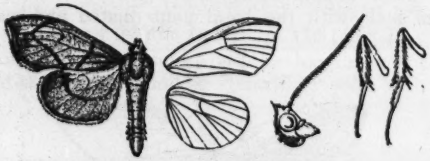
Type. SPARAGMIA GIGANTALIS Guen. Delt. & Pyr. p. 216, pl. 6. f. 10. W. Indies; Tropical America.

Genus 121. ANARMODIA.

Anarmodia Led. Wien. Ent. Mon. 1863, p. 412.

Palpi porrect, triangularly scaled, extending about the length of head, the 3rd joint hidden by hair; maxillary palpi strongly dilated with scales; frons flat and oblique; antennæ of male ciliated; mid and hind tibiæ strongly fringed with hair, the outer spurs about half the length of inner. Fore wing long and narrow; the apex produced and acute; the outer margin strongly excurved at middle; veins 3, 4, 5 from angle of cell; 7 curved and approximated to 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 121.



Anarmodia sibilalis, ♂. ½.

(1)*ANARMODIA PONTEALIS Druce, Biol. Centr.-Am., Het. ii. p. 218, pl. 61. f. 6. Mexico; Centr. Amer.

(2) ANARMODIA SIBILALIS Guen. Delt. & Pyr. p. 215. Brazil.

(3) ANARMODIA INSCRIPTALIS Guen. Delt. & Pyr. p. 213. Ecuador.

(4) ANARMODIA BISTRALIS Guen. Delt. & Pyr. p. 214. Colombia.

(5)†Anarmodia punctilinealis, n. sp.

♂. Fulvous yellow; pectus and ventral surface of abdomen pale yellow. Fore wing with slightly waved antemedial fuscous line oblique from costa to below median nervure, where it is obtusely angled; a point in cell and discoidal lunule; a curved series of postmedial black points on the veins, with diffused fuscous patch beyond them between veins 3 and 6; cilia dark at base, pure white at tips. Hind wing with the basal and inner areas paler; a black discoidal point; a crenulate postmedial line; cilia brown at base with fuscous points, the tips white mixed with brown and fuscous.

Hab. Ecuador, Loja. *Exp.* 50 mm.

(6) Anarmodia clamalis Guen. Delt. & Pyr. p. 215. Brazil.

(7)*Anarmodia majoralis Guen. Delt. & Pyr. p. 215. Brazil.

(8) Anarmodia corylalis Guen. Delt. & Pyr. p. 214. Colombia.

Type. (9) Anarmodia inferioralis Guen. Delt. & Pyr. p. 214. C. & S. America.

„ *longinqualis* Led. Wien. Ent. Mon. 1863, p. 413.

Acrospila phellinoidalis Maasen, Stubel's Reise, p. 170, pl. ix. f. 26.

Auctorum.

Atheropoda flaccidalis Snell. Tijd. v. Ent. xxxv. p. 169. Peru.

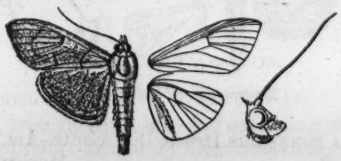
„ *inflexalis* Snell. Tijd. v. Ent. xxxv. p. 169 = *majoralis* Led. pl. iii. f. 9 (nec Guen.). Brazil.

Genus 122. Condylorrhiza.

Condylorrhiza Led. Wien. Ent. Mon. 1863, p. 393.

Palpi porrect, triangularly scaled, the 3rd joint concealed; maxillary palpi dilated with scales; frons flat and oblique; antennæ of male with the basal joint dilated and bearing a tuft

Fig. 122



Condylorrhiza vestigialis, ♂. ½.

of scales on inner side, the shaft almost simple; mid and hind tibiæ with the outer spurs short. Fore wing with vein 3 from angle of cell; 4, 5 approximated for a short distance; 7 strongly curved and approximated to 8, 9. Hind wing with veins 3, 4, 5

from angle of cell; 6, 7 stalked, 7 anastomosing with 8; male with a hairy fold on inner area above.

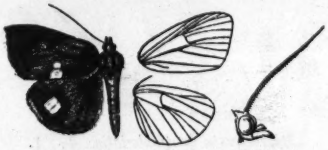
Type. CONDYLORRHIZA VESTIGIALIS Guen. Delt. & Pyr. p. 321. S. Amer.
†*Botys tritealis* Wlk. xviii. 597.
† „ *mestoralis* Wlk. xviii. 729.

Genus 123. AGASTYA.

Agastya Moore, P. Z. S. 1881, p. 378.

Palpi porrect, projecting about the length of head and downcurved; maxillary palpi with a sharp tuft of hair from extremity; frons rounded; antennæ ciliated; tibiæ with the outer spurs about two-thirds length of inner; mid tibiæ fringed with coarse hair on outer side. Fore wing broad, the costa very much arched at base; veins 3, 4, 5 from angle of cell; 7 straight and well separated from 8, 9, to which 10 is approximated. Hind wing broad; the cell short; vein 2 from near angle; 3, 4, 5 approximated for some distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 123.



Agastya hyblæoides, ♂. ½. (From Moths Ind. vol. iv.)

Type. †AGASTYA HYBLÆOIDES Moore, P. Z. S. 1881, p. 379. Sikhim.
„ *flavomaculata* Moore, P. Z. S. 1881, p. 379.

Genus 124. PROTRIGONIA.

Protrigonia Hmpsn. Moths Ind. iv. p. 414 (1896).

Palpi porrect, projecting about the length of head, downcurved, and the 3rd joint hidden; maxillary palpi with a pointed

Fig. 124.

Protrigonia zizanialis, ♂. ½. (From Moths Ind. vol. iv.)

tuft at extremity; frons rounded; antennæ of male somewhat thickened and flattened; tibiæ with the spurs nearly equal. Fore wing with vein 3 from before angle of cell; 4, 5 from angle;

7 straight and well separated from 8, 9. Hind wing with the cell about half the length of wing; vein 3 from before angle; 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing with 8.

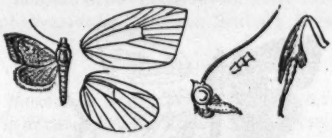
Type. †PROTRIGONIA ZIZANIALIS Swinh. P. Z. S. 1885, p. 865, pl. 57. f. 2. W. India & Ceylon.

Genus 125. MICROCAUSTA.

Microcausta Hmpsn. A. M. N. H. (6) xvi. p. 340 (1895).

Palpi porrect, extending about twice the length of head, downcurved at extremity, the 3rd joint hidden in hair; maxillary palpi triangularly scaled; frons rounded; antennæ annulate; hind tibiæ of male fringed with extremely long hair on outer side and with tufts of hair towards extremity, the spurs absent, the first joint of tarsus fringed with hair. Fore wing broad, the apex produced and acute; veins 3, 4, 5 from close to angle of cell; 7 straight and well separated from 8, 9. Hind wing with veins 3 and 5 from angle of cell; 4 absent; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 125.



Microcausta ignifimbrialis, ♂. ½.

Type. †MICROCAUSTA IGNIFIMBRIALIS Hmpsn. A. M. N. H. (6) xvi. p. 340. W. Indies.

Genus 126. NOORDA.

Noorda Wlk. xix. 978 (1857).

Palpi porrect, the 3rd joint long and downcurved; maxillary palpi with a long pointed tuft in front; frons rounded; tibiæ with the outer spurs about half the length of inner. Fore wing

Fig. 126.

Noorda blitealis, ♂. ½. (From Moths Ind. vol. iv.)

narrow; vein 3 from before angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9. Hind wing with veins 4, 5 approximated for a short distance; 6, 7 from upper angle; 7 anastomosing with 8.

SECT. I. Antennæ of male almost simple.

(1) NOORDA IGNEALIS, n. sp.

Bright yellow; head, thorax, and abdomen suffused with fiery red in parts; palpi at base and rings on abdomen towards extremity, pectus, and ventral surface of abdomen white. Fore wing with the costal area fiery red, the costa itself dark; dentate subbasal, medial, and postmedial lines, the last two oblique, the 2nd expanding into a discoidal spot, the last slightly excurved between veins 7 and 3; terminal area red, leaving a yellow edge to postmedial line; a diffused purplish-fuscous terminal band; cilia white, black at apex and below middle. Hind wing with the terminal area purplish, narrowing to tornus; cilia white, blackish at apex and middle.

Hab. Fergusson I., N. Guinea; Cooktown, Queensland (*Meek*). *Exp.* 16 mm. Types in Coll. Rothschild and B.M.

(2)†NOORDA ESMERALDA, n. sp.

Emerald-green; head whitish; palpi brown at sides; antennæ fulvous; hind wing greenish white, the termen green.

Hab. Mexico, Jalapa (*Schaus*); Venezuela, Aroa. *Exp.* 36 mm.

SECT. II. Antennæ of male with long cilia.

(3)†NOORDA FESSALIS Swinh. P. Z. S. 1886, p. 459, pl. 41. f. 13. W. Africa; Aden; India; Burma; Andamans.
†*Autocharis amethystina* Swinh. A. M. N. H. (6) xiv. p. 149.

(4)*NOORDA SINUALIS, n. sp.

♀. Head and thorax fuscous; abdomen banded fuscous and white. Fore wing with the basal half of costal area suffused with fuscous; some black scales at base of inner margin; the antemedial line represented by some black scales in and below cell and on inner margin; the postmedial line sinuous, angled inwards below costa and outwards on vein 4, some diffused fuscous scales before it, and the area beyond it greyish fuscous with a sinuous subterminal line with diffused black on its inner side; cilia pale reddish brown. Hind wing hyaline, with fuscous terminal band narrowing from costa to vein 1.

Hab. Natal, Weenen. *Exp.* 16 mm. Type in Coll. Rothschild.

Type. (5)†NOORDA BLITEALIS Wlk. xix. 979. Aden; India; Ceylon.
†*Scopula subjectalis* Wlk. xxxiv. 1472.

(6) NOORDA MARGARITALIS, n. sp.

♂. Head, thorax, and abdomen white; palpi black; anal tuft blackish. Fore wing pearly white; a bright red fascia on costa, terminating at middle in a triangular patch with its apex conjoined to outer area; the outer area brown, defined by a sinuous black line on inner side, with a broad silvery purple band on it

and becoming bright red at costa; a marginal white line emitting a curved mark below the apical red patch. Hind wing pearly white; the outer area brown and fuscous, almost wholly suffused with silvery purple, and with its medial part defined by a black line on inner side; a marginal white line; cilia of both wings pale brown, with silvery reflections.

Hab. Kikuya, German E. Africa (*Ansorge*); Sierra Leone (*Clements*). *Exp.* 24 mm. Type in B.M.

(7) NOORDA NIGROPUNCTALIS, n. sp.

♂. Yellowish white; palpi, sides of head, and shoulders brown; anal tuft fuscous. Fore wing with the costa reddish brown; two black points in cell, one at each angle and one on middle of inner margin; terminal area purplish fuscous, with minutely waved black line on its inner edge, bent outwards at vein 3. Hind wing with the apical area purple-fuscous, with minutely waved black line on its inner edge.

Hab. Perak; Gunong Ijan, Malay States. *Exp.* 18 mm. Types in Coll. Rothschild and B.M.

Genus 127. DAUSARA.

Dausara Wlk. xvii. 507 (1859).

Palpi porrect, rather long, triangularly scaled, the 3rd joint hidden; maxillary palpi with a long sharp tuft from extremity; frons flattened and oblique; antennæ of male much thickened and flattened; tibiæ with the outer spurs about two-thirds length of inner. Fore wing with the inner margin lobed at middle; veins 3, 4, 5 well separated at origin; 7 curved and closely approximated to 8, 9, to which 10 also is approximated. Hind wing with the cell short; veins 3, 4, 5 well separated at origin; 6, 7 from upper angle, 7 anastomosing slightly with 8.

Fig. 127.

Dausara talliusalis, ♂. ½. (From Moths Ind. vol. iv.)

SECT. I. Fore wing of male with the median nervure bent upwards; a large tuft of scales on underside below its basal half, and a smaller tuft in middle of cell.

Type. (1) DAUSARA TALLIUSALIS Wlk. xvii. 507. Assam; Burma; Andamans; Borneo.

†*Glyphodes marginalis* Moore, P. Z. S. 1877, p. 618, pl. 60. f. 15.

Sect. II. Fore wing of male normal.

(2)†Dausara orionalis Wlk. xvii. 501. Borneo.

(3)†Dausara amethysta Butl. Tr. Linn. Soc. (2) Zool. i. p. 563. Malacca; Borneo.

Genus 128. Hemiscopis.

Hemiscopis Warr. A. M. N. H. (6) vi. p. 475 (1890).
Micromania Swinh. A. M. N. H. (6) xiv. p. 141 (1894).

Palpi porrect, rather long and triangularly scaled, the 3rd joint hidden; maxillary palpi with a long pointed tuft in front; frons rounded; antennæ almost simple and minutely annulated; tibiæ with the outer spurs about half the length of inner. Fore wing with the apex somewhat acute, the outer margin rounded; veins 3 and 5 from near angle of cell; 7 straight and well separated from 8, 9. Hind wing with veins 4, 5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing shortly with 8.

Fig. 128.

Hemiscopis suffusalis, ♂. ½. (From Moths Ind. vol. iv.)

Type. (1)†Hemiscopis suffusalis Wlk. xxxiv. 1471; Hmpsn. Ill. Het. ix. pl. 173. f. 18. S. India; Ceylon; Burma; Sumatra; Borneo.
Botys snellemanni Snell. Midd.-Sum., iv. Lep. p. 61.

(2)†Hemiscopis cinerea Warr. A. M. N. H. (6) ix. p. 396. Japan.

(3)†Hemiscopis expansa Warr. A. M. N. H. (6) ix. p. 396. N.W. Himalayas.

(4)†Hemiscopis stigmatilis Swinh, A. M. N. H. (6) xiv. p. 141. Assam.

Genus 129. Mecyna.

Mecyna Guen. Delt. & Pyr. p. 406 (1854).
Tholeria Hübn. Verz. p. 354 (1827), non descr.

Palpi porrect, long, rostriform, and downcurved, the 3rd joint partially hidden; maxillary palpi dilated with scales at extremity; frons oblique; antennæ of male minutely ciliated; mid tibiæ with a groove containing a tuft of hair; hind tibiæ with the outer spurs about half the length of inner. Fore wing rather narrow, the costa arched towards apex; veins 3 and 5 from close to angle of cell; 7 straight and well separated from 8, 9, to which 10 is

approximated. Hind wing with the cell short; veins 4, 5 closely approximated for a short distance; 6, 7 stalked, 7 anastomosing strongly with 8.

Fig. 129.

Mecyna gilvata, ♂. ½. (From Moths Ind. vol. iv.)

(1) MECYNA LIMBALIS Schiff. Wien. Verz. p. 122. Europe.
Pyralis rusticalis Hübn. Pyr. f. 121.

Type. (2) MECYNA GILVATA Fabr. Ent. Syst. p. 290. S. & E. Europe;
Pyralis orientalis Fabr. Ent. Syst. iii. 2, p. 234. Madeira; Syria; Abyssinia; Aden;
Pyralis polygonalis Hübn. Schmett. Eur., Pyr. ff. 617, 204, 205. India; Ceylon.
Pyralis diversalis Hübn. Schmett. Eur., Pyr. f. 102.
Mecyna aversalis Guen. Delt. & Pyr. p. 409, pl. 4. f. 12.
„ *teriadalis* Guen. Delt. & Pyr. p. 409.
† „ *deprivalis* Wlk. xix. 806; Moore, Lep. Ceyl. iii. pl. 179. ff. 1, 1 *a*.

(3) MECYNA REVERSALIS Guen. Delt. & Pyr. p. 409. U.S.A.; W. Indies.
(4)†MECYNA PRUNIPENNIS Butl. A. M. N. H. (5) iv. p. 454 (1879). Japan.
(5) MECYNA ORNITHOPTERALIS Guen. Delt. & Pyr. p. 411, pl. 8. f. 12. Australia.

(6) MECYNA MAORIALIS Feld. Reis. Nov. pl. 134. f. 34. N. Zealand.
(7)†MECYNA VIRESCENS Butl. A. M. N. H. (5) vii. p. 329 (1881). Hawaii.

(8)†MECYNA APICALIS, n. sp. (1898, Plate L. fig. 28.)

♂. Head and thorax ferruginous brown; abdomen pale brown. Fore wing yellow-brown, suffused with ferruginous red and more or less irrorated and suffused with fuscous; traces of a pale, highly waved antemedial line, especially on inner area; some black marks on veins at end of cell and slight patches of hyaline membrane in the discal interspaces, with a pale waved line beyond them, dentate beyond the cell and below vein 2; an indistinct minutely waved ochreous postmedial line; a silvery white bidentate mark below apex, with a fuscous streak below it; a marginal series of black specks; cilia fuscous, with a white line at base. Hind wing hyaline yellow, with all the veins streaked with fuscous, and a fuscous marginal band.

♀ redder; the hind wing without the streaks on veins, the marginal band red tapering to anal angle.

Hab. Lower Amazons (*Austen*). *Exp.* 28 mm.

Auctorum.

Tholeria illiberalis Hübn. Zutr. ff. 349, 350. Surinam.

Genus 130. BŒOTARCHA.

Bœotarcha Meyr. Trans. Ent. Soc. 1884, p. 305.

Palpi porrect, long, rostriform, and downcurved; maxillary palpi large and dilated with scales; frons with a conical prominence; antennæ thickened and flattened; tibiæ with the outer spurs half the length of inner. Fore wing typically long and narrow; vein 3 from before angle of cell; 4, 5 well separated at origin; 7 straight and well separated from 8, 9. Hind wing with veins 4, 5 somewhat approximated for a short distance; 6, 7 from upper angle, 7 anastomosing slightly with 8.

Fig. 130.

Bœotarcha martinalis, ♂. ½. (From Moths Ind. vol. iv.)

(1)*BŒOTARCHA DEMANTRIALIS Druce, Biol. Centr.-Am., Het. ii. p. 270, pl. 63. f. 6. Mexico; Centr. Amer.

(2)†BŒOTARCHA MARTINALIS Wlk. xviii. 791. Burma.
†*Botys crassicornis* Wlk. xxxiv. 1455.

Type. (3) BŒOTARCHA TÆNIALIS Snell. Tijd. v. Ent. 1880, p. 209, and 1883, pl. 7. f. 3. N. Australia.

(4)†BŒOTARCHA HYALINALIS Hmpsn. Moths Ind. iv. p. 419. E. Himalayas; Andamans.

(5)†BŒOTARCHA STIGMOSALIS Warr. A. M. N. H. (6), ix. p. 249. Brazil.

(6) BŒOTARCHA CŒMAROALIS Wlk. xix. 1011. Brazil.

(7)†BŒOTARCHA MARGARITA Warr. A. M. N. H. (6) ix. p. 430. Brazil.

(8)†BŒOTARCHA LIMBATA Butl. Trans. Ent. Soc. 1886, p. 430. Australia.

Genus 131. ATELOCENTRA.

Atelocentra Meyr. Trans. Ent. Soc. 1884, p. 323.

Palpi porrect, downcurved, extending about three times length of head, the 3rd joint hidden in hair; maxillary palpi dilated with

scales: antennæ laminate and with rings at the joints; hind tibiæ with the inner medial spur about $\frac{1}{3}$th outer. Fore wing with vein 3 from before angle of cell; 4, 5 separate at origin. Hind wing with vein 3 from angle of cell; 4, 5 somewhat approximated for some distance; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 131.

Atelocentra chloraspis, ♂. ½.

Type. *Atelocentra chloraspis Meyr. Trans. Ent. Soc. 1884, p. 323. Australia.

Genus 132. Protocolletis.

Protocolletis Meyr. Trans. Ent. Soc. 1888, p. 223.

Palpi porrect, downcurved, extending more than twice the length of head, fringed with rough hair above and below, the 3rd joint concealed; maxillary palpi triangularly scaled; frons rounded; antennæ of male ciliated; hind tibiæ with the outer medial spur one half length of inner. Fore wing with veins 3, 4, 5 from angle of cell; 7 straight and well separated from 8, 9; 10 anastomosing with 8, 9, or free. Hind wing with vein 3 from angle of cell; 4, 5 approximated for a short distance; 6, 7 shortly stalked, 7 anastomosing with 8 to two-thirds of wing.

Fig. 132.

Protocolletis constricta, ♂. ½.

Type. (1)†Protocolletis constricta Butl. Trans. Ent. Soc. 1882, p. 40. Hawaii.

(2)†Protocolletis litorea Butl. E. M. M. xix. p. 178. Hawaii.

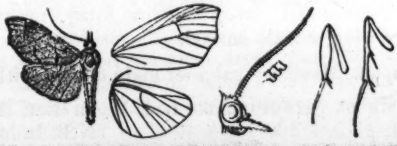
Genus 133. Adena.

Adena Wlk. xxvii. 197 (1863).
Deana Butl. A. M. N. H. (5) iv. p. 451 (1879).
Nesarcha Meyr. Trans. Ent. Soc. 1884, p. 330.

Palpi porrect, rostriform, downcurved, extending about twice the

length of head, the 3rd joint hidden by hair; maxillary palpi strongly dilated with scales; frons flat and oblique; antennæ of male laminate; mid tibiæ dilated; hind tibiæ of male with the inner spurs minute. Fore wing with the apex produced and acute; the termen produced to an angle at middle; vein 3 from before angle of cell; 4, 5 from angle; 7 curved and somewhat approximated to 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 stalked, 7 anastomosing with 8.

Fig. 133.



Adena hybreasalis, ♂. ½.

Type. †ADENA HYBREASALIS Wlk. xviii. 797. New Zealand.
†*Scopula paronalis* Wlk. xviii. 797.
†*Adena xanthialis* Wlk. xxvii. 198.

Auctorum.

Nesarcha bilunalis Snell. Tijd. v. Ent. xxxviii. p. 153. Java.

Genus 134. CALAMOCHROUS.

Calamochrous Led. Wien. Ent. Mon. 1863, p. 386.
Sclerocona Meyr. Trans. Ent. Soc. 1890, p. 445.
Notaspis Warr. A. M. N. H. (6) ix. p. 297 (1891).
Dicepolia Snell. Tijd. v. Ent. xxxv. p. 158 (1893).

Palpi porrect, long and downcurved, the 3rd joint hidden; frons oblique; maxillary palpi dilated with scales; antennæ of male minutely ciliated; tibiæ with the spurs long. Fore wing with the

Fig. 134.

Calamochrous tranquillalis, ♂. ½. (From Moths Ind. vol. iv.)

apex somewhat produced; vein 3 from near angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9. Hind wing with the cell short; veins 3, 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing with 8.

Sect. I. (*Sclerocona*). Fore wing of male with the retinaculum formed by a large valve of scales below the cell, the median nervure bent upwards; a hyaline streak above base of vein 7, which is bent downwards; vein 10 anastomosing with 8, 9 (abnormally absent and 11 anastomosing with 8, 9).

(1) Calamochrous acutellus Ev. Bull. Mosc. 1842, p. 563. S.E. Europe; Japan; China.
Duponchelia cilialis H.-S. iv. p. 8, f. 60.
†*Crambus sinensellus* Wlk. xxvii. 167.
† „ *tincticostellus* Wlk. xxvii. 167.

Sect II. Fore wing of male normal.

A. (*Notaspis*). Maxillary palpi strongly dilated with scales.

(2) Calamochrous tranquillalis Led. Wien. Ent. Mon. 1863, p. 371, pl. 9. f. 16. N.E. India; Ternate.

(3) Calamochrous ferruginalis Hmpsn. Moths Ind. iv. p. 420. Sikhim.

(4)†Calamochrous carnealis Swinh. A. M. N. H. (6) xvi. p. 302. Assam.

(5)†Calamochrous ruficostalis Hmpsn. Moths Ind. iv. p. 420. Sikhim.

(6)†Calamochrous roseobrunnea Warr. Trans. Ent. Soc. 1889, p. 260. Brazil.

B. (*Calamochrous*). Maxillary palpi slightly dilated with scales.

(7)†Calamochrous dichroma Moore, Lep. Atk. p. 223. Sikhim.
„ *brevipalpis* Snell. Trans. Ent. Soc. 1890, p. 599.

Type. (8) Calamochrous chilonalis Led. Wien. Ent. Mon. 1863, p. 387, pl. 12. f. 10. Venezuela.

(9)†Calamochrous straminea Warr. A. M. N. H. (6) ix. p. 393. California.

Genus 135. Cybolomia.

Cybolomia Led. Wien. Ent. Mon. 1863, p. 420.
Hypolais Guen. Delt. & Pyr. p. 239 (1854), preocc.
Palpi porrect, triangularly scaled, the 3rd joint concealed

Fig. 135.

Cybolomia pentadalis, ♂. 1.

maxillary palpi with a long pointed tuft in front; frons flat and oblique; antennæ of male thickened and laminate; hind tibiæ with the outer medial spur about one-third length of inner. Fore wing with veins 3, 4, 5 separate at origin; 7 straight and well separated from 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 stalked, 7 anastomosing shortly with 8.

Sect. I. Hind wing with veins 4, 5 somewhat approximated for a short distance.

(1)†Cybolomia ossealis, n. sp.

Pale ochreous; palpi brown at sides; frons with lateral white lines; abdomen whitish. Fore wing irrorated with a few brown scales; the costal and terminal areas purplish brown; brown points near base and middle of cell and a diffused discoidal lunule; a postmedial series of points excurved between veins 7 and 5 and at vein 3, then retracted to below angle of cell. Hind wing white, with indistinct postmedial series of brown points on the veins, retracted at vein 2 to below angle of cell; the termen brown from apex to vein 2.

Hab. Ecuador, Loja. *Exp.* 24 mm.

Subsp. 1. Abdomen and hind wing pale ochreous.

Hab. Mexico, Orizaba (*Schaus*). *Exp.* 20 mm.

Sect. II. Hind wing with veins 4, 5 not approximated.

(2) Cybolomia nemausalis Dup. Lép. Fr. viii. p. 377, pl. 236. f. 7. S. Europe.

Scopula argillacealis Zell. Isis, 1847, p. 579.

(3) Cybolomia dulcinalis Tr. Schmett. Eur. x. 3, p. 35. S.E. Europe; W. Asia.

Type. (4) Cybolomia pentadalis Led. Verh. z.-b. Ver. Wien, 1855, p. 217, pl. 3. f. 13. W. Asia.

(5) Cybolomia lutosalis Mann. Wien. Ent. Mon. 1862, p. 387, pl. 3. S. Europe; W. Asia.

(6)†Cybolomia inglorialis Zell. ? MS. Scharud.

(7) Cybolomia siccalis Guen. Delt. & Pyr. p. 240, pl. 7. f. 10. S. Europe.

Botys glyceralis Stgr. S. E. Z. 1859, p. 220.

„ *sexpunctalis* Chrét. Le Nat. 1891, p. 67.

(8) Cybolomia fractilinealis Chr. Hor. Ent. Ross. x. p. 42. Persia; Turkestan.

(9)†Cybolomia albilinealis Hmpsn. P. Z. S. 1896, p. 274, pl. 10. f. 4. Aden.

(10)†Cybolomia extorris Warr. A. M. N. H. (6) ix. p. 395. U.S.A.

Auctorum.

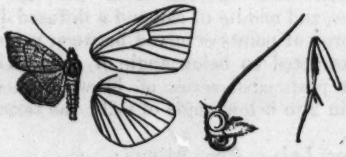
Cybolomia gratiosalis Rom. Mém. iii. p. 40, pl. ii. f. 9. Turkestan.

Genus 136. Prochoristis.

Prochoristis Meyr. Trans. Ent. Soc. 1890, p. 458.

Palpi porrect, triangularly scaled, the 3rd joint concealed; maxillary palpi triangularly dilated with scales; frons rounded; antennæ of male thickened and laminate; mid tibiæ of male dilated with a groove and tuft; hind tibiæ with the outer medial spur one-half length of inner. Fore wing with the apex somewhat produced; veins 3, 4, 5 well separated at origin; 7 straight and well separated from 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6 from below upper angle; 7 anastomosing with 8.

Fig. 136.



Prochoristis rupicapralis, ♂. ½.

Type. (1) Prochoristis rupicapralis Led. Verh. z.-b. Ver. Wien, 1855, p. 218, pl. 3. f. 12. W. Asia.

(2) Prochoristis capparidis Christ. Hor. Ent. Ross. xii. 1876, p. 272, pl. 7. f. 43. Turkestan.
Botys daghestanica Christ. Hor. Ent. Ross. xii. p. 273, f. 44 (var.).

Auctorum.

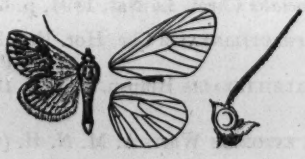
Ebulea simplicialis Brem. Ost-Sib. p. 71, pl. 6. f. 13. Amur.

Genus 137. Cynæda.

Cynæda Hübn. Verz. p. 346 (1827).
Odontia Dup. viii. p. 83 (1831).

Palpi porrect, extending about the length of head, triangularly

Fig. 137.



Cynæda dentalis, ♂. ½.

scaled, the 3rd joint hidden in hair; maxillary palpi strongly dilated with scales; frons rounded; antennæ of male strongly

ciliated; tibiæ with the outer spurs two-thirds length of inner. Fore wing with a large tuft of rough hair on inner margin before middle; vein 3 from before angle of cell; 4, 5 separate at origin; 7 straight and well separated from 8, 9. Hind wing with veins 3, 4, 5 well separated at origin; 6, 7 from upper angle, 7 anastomosing with 8.

Type. (1) CYNÆDA DENTALIS Schiff. Wien. Verz. p. 120; & Dup. Lép. Fr. viii. pl. 215. f. 1. Europe; W. Asia.
Noctua fulminans Fabr. Ent. Syst. no. 311.
Phalæna ramalis Fabr. Ent. Syst. no. 378.
Noctua radiata Esp. iv. p. 374.

(2) CYNÆDA FURIOSA Stgr. List, xxxiii. Syria.

Auctorum.

Odontia exoticalis Snell. Tijd. v. Ent. xviii. p. 191, pl. xi. f. 3. W. Indies.

Genus 138. MNESICTENA.

Mnesictena Meyr. Trans. Ent. Soc. 1884, p. 328.

Palpi porrect, extending about one and a half times length of head, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi strongly dilated with scales; frons rounded; antennæ of male minutely ciliated; tibiæ with the outer spurs two-thirds length of inner. Fore wing with vein 3 from before angle of cell; 4, 5 separate at origin; 7 straight and well separated from 8, 9. Hind wing with the median nervure loosely pectinated; vein 3 from near angle of cell; 4, 5 separate at origin; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 138.

Mnesictena quadralis, ♂. ½.

Type. (1) MNESICTENA QUADRALIS Doubl. Dieff. N. Zeal. i. p. 288. New Zealand.
„ *marmorina* Meyr. Trans. Ent. Soc. 1884, p. 329.

(2)†MNESICTENA NOTATA Butl. Cist. Ent. ii. p. 493. New Zealand.

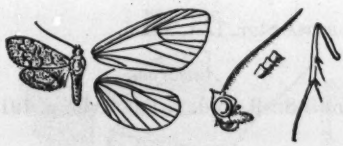
(3) MNESICTENA FLAVIDALIS Doubl. Dieff. N. Zeal. i. p. 287.
†*Scopula dipsasalis* Wlk. xviii. 796. New Zealand.
Botys otagalis Feld. Reis. Nov. pl. 134. f. 35.

Genus 139. Exeristis.

Exeristis Meyr. Trans. Ent. Soc. 1886, p. 266.

Palpi porrect, triangularly and roughly scaled, the 3rd joint hidden; maxillary palpi dilated with scales; frons with rounded prominence; antennæ ciliated and annulated; hind tibiæ with the outer medial spur minute in both sexes. Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9. Hind wing with veins 3, 4, 5 from angle of cell.

Fig. 139.



Exeristis asyphela, ♂. ½.

Sect. I. Hind wing with veins 6, 7 stalked; 7 anastomosing with 8 to near apex.

Type. (1)†Exeristis asyphela Meyr. Trans. Ent. Soc. 1886, p. 266. Tonga.

Sect. II. Hind wing with veins 6, 7 from angle of cell; 7 anastomosing with 8 to two-thirds of wing.

(2)†Exeristis xanthota Meyr. Trans. Ent. Soc. 1886, p. 267. Fiji.

Genus 140. Monocona.

Monocona Warr. A. M. N. H. (6) ix. p. 173 (1892).

Palpi porrect, clothed with very long hair below, the 3rd joint hidden; maxillary palpi dilated with hair; frons with long corneous

Fig. 140.

Monocona rubralis, ♂. ½.

prominence with vertical edge excised in front; antennæ cilliated tibiæ roughly scaled, the spurs moderate. Fore wing with veins

3, 4, 5 separate; 7 straight and well separated from 8, 9; (10 on right-hand side of one specimen forking and giving rise to an extra vein). Hind wing with veins 2 and 3 from near angle of cell; 4, 5 from angle; discocellulars very oblique; 6, 7 from upper angle, anastomosing with 8.

Type. †Monocona rubralis Warr. A. M. N. H. (6) ix. p. 174 (1892). California.

Genus 141. Endolophia, nov.

Palpi downcurved, extending about twice the length of head, the 3rd joint hidden in hair; maxillary palpi dilated with scales; frons with pointed conical prominence; antennæ ciliated; mid and hind tibiæ with the outer spur about two-thirds length of inner. Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9; 10, 11 from cell; a large scale-tooth on middle of inner margin. Hind wing with the cell short; vein 3 from angle; 4, 5 stalked; 6, 7 from upper angle.

Fig. 141.

Endolophia rufitinctalis, ♂. ♩.

Type. †Endolophia rufitinctalis, n. sp.

♂. Ferruginous red; palpi tinged with fuscous; sides of frons and antennæ greyish; front of pectus, fore tarsi, and mid and hind legs almost pure white; abdomen pale rufous, with whitish segmental rings. Fore wing with the costa darker; a curved antemedial line; a discoidal spot; the postmedial line excurved to vein 3, then incurved; scale-tooth black; a terminal black line; cilia white at tips, except at apex and tornus. Hind wing yellowish white, the veins and termen tinged with brown.

Hab. Jalapa, Mexico (*Schaus*). *Exp.* 16 mm. Types in B.M. and Coll. Schaus.

Genus 142. Autocosmia.

Autocosmia Warr. A. M. N. H. (6) ix. p. 432 (1892).

Palpi porrect, triangularly scaled, extending about the length of head, and the 3rd joint hidden by hair; maxillary palpi filiform: frons with a conical prominence; antennæ of female nearly simple; hind tibiæ with the outer spurs half the length of inner. Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9. Hind wing with vein 3

from angle of cell; 4, 5 stalked; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 142.

Autocosmia concinna, ♀. ¾.

Type. (1)†Autocosmia concinna Warr. A. M. N. H. (6) ix. p. 433. U.S.A.

(2) Autocosmia otiosalis Led. Wien. Ent. Mon. 1863, p. 373, pl. 10. f. 10. Brazil.

Genus 143. Criophthona.

Criophthona Meyr. Trans. Ent. Soc. 1884, p. 339.

Palpi porrect, straight, rather long, roughly scaled, the 3rd joint hidden; maxillary palpi dilated with scales; frons with long truncate conical prominence; antennæ ciliated; hind tibiæ with the outer spurs about half the length of inner. Fore wing with veins 3, 4, 5 from angle of cell; 7 straight and well separated from 8, 9. Hind wing with vein 3 from before angle of cell; 6, 7 shortly stalked, 7 anastomosing with 8.

Fig. 143.

Criophthona finitima, ♂. ¾.

Sect. I. Antennæ with the shaft roughly scaled above; hind wing with veins 4, 5 from angle of cell.

(1)*Criophthona haliaphra Meyr. Trans. Ent. Soc. 1884, p. 340. Australia.

Sect. II. Antennæ with the shaft smoothly scaled; hind wing with vein 5 from above angle of cell.

Type. (2)*Criophthona finitima Meyr. Trans. Ent. Soc. 1884, p. 340. Australia.

(3)*Criophthona harmodia Meyr. Trans. Ent. Soc. 1887, p. 243. Australia.

Genus 144. Titanio.

Titanio Hübn. Verz. p. 350 (1827).
Eurrhypis Hübn. Verz. p. 351.
Metaxmeste Hübn. Verz. p. 351.
Catharia Led. Wien. Ent. Mon. 1863, p. 353.

Palpi porrect, fringed with extremely long hair below, the 3rd joint hidden; maxillary palpi with long hair at extremity; frons with rounded prominence, clothed with rough hair; antennæ ciliated; legs moderately hairy, the spurs nearly equal; wings short and broad. Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 7 straight. Hind wing with the cell short; 3, 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 144.

Titanio normalis, ♂. §.

(1) Titanio pollinalis Schiff. W. V. p. 124. U.S.A.; S. Europe;
Noctua biguttu Schaeff. Icon. pl. 275. ff. 5, 6. Australia.
†*Ennychia melissalis* Wlk. xvii. 331.
†*Botis flavinotalis* Grote, Can. Ent. xiii. p. 34.
„ *guttulalis* H.-S. iv. p. 16, ff. 96, 97.

(2) Titanio sartalis Hübn. Pyr. ff. 173, 174. W. Asia.
Hercyna caucalis H.-S. N. Schmett. p. 11, ff. 76, 77.

(3) Titanio magnificalis Christ. Hor. Ent. Ross. xii. p. 266, pl. 7. f. 35. Turkestan.

(4) Titanio venustalis Led. Verh. z.-b. Ver. Wien, 1855, p. 250; Rom. Mém. iii. pl. 1. f. 10. Greece; W. Asia.
„ *echinæa* Meyr. Ent. Mo. Mag. (2) ii. p. 50.

Type. (5) Titanio normalis Hübn. Pyr. ff. 41, 110. S. Europe.
Pyralis comitalis Hübn. Pyr. f. 180.

(6) Titanio originalis H.-S. N. Schmett. p. 11, f. 78. W. Asia.

(7) Titanio ephippialis Zett. Ins. Lap. 971. Labrador;
Boreophila frigidalis Guen. Delt. & Pyr. p. 157. N. Europe.
„ *scandinavalis* Guen. Delt. & Pyr. p. 156.

(8) Titanio pyrenæalis Dup. Lép. Fr. iv. p. 400, pl. 82. f. 6.
Hercyna simplonialis H.-S. Eur. Schmett. iv. ff. 31–34. C. Europe.

(9) TITANIO SCHRANKIANA Hockenw. Beitr. vi. p. 336, pl. vii. f. 6.
Noctua lugubrina Esp. iv. p. 189. C. Europe.
Pyralis holesericealis Hübn. Pyr. f. 112.

(10) TITANIO PHRYGIALIS Hübn. Pyr. f. 42. Europe.
Pyralis rupicolalis Hübn. Pyr. ff. 139 & 198–200.
Noctua monedula Esp. iv. pl. 197. ff. 5, 6.
Pyralis sericealis Hübn. Pyr. f. 43 (var.).
„ *nevadalis* Stgr. S. E. Z. 1859, p. 220 (var.).

(11)†TITANIO DAPHALIS Grote, Can. Ent. xiii. p. 17. U.S.A.

Auctorum.

Botys bububattalis Hulst, Tr. Am. Ent. Soc. xiii. p. 149. U.S.A.
Titanio zachlora Meyr. E. M. M. (2) ii. p. 11. Algeria.
„ *proximalis* Fern. Insect Life, vi. p. 256. California.
Hercyna cacuminalis Ev. F. V. U. p. 476. S. Russia; W. Asia.
Noctuomorpha modestalis Christ. Hor. Ent. Ross. xii. p. 267, pl. 7. f. 38. Turkestan.
Noctuomorpha pulchellalis Stgr. Deutsche E. Zeit., Lep. v. pl. iii. f. 20, & vi. p. 71. C. Asia.
Titanio eponyma Meyr. Trans. Ent. Soc. 1890, p. 454. Transcaucasus.
=*Threnodes mœschleri* Rom. Mém. iii. p. 22, pl. 1. f. 11 (*nec* Christ.).
Hercyna heliothalis Stgr. Deutsche E. Zeit., Lep. v. pl. iii. f. 18 & vi. p. 74. C. Asia.
„ *paschalis* Stgr.? ined.
„ *sultanalis* Stgr. Deutsche E. Zeit., Lep. v. pl. iii. f. 19 & vi. p. 75. C. Asia.
„ *sericatalis* H.-S. iv. p. 17, ff. 28–36. S.E. Europe.

Genus 145. METASIA.

Metasia Guen. Delt. & Pyr. p. 251 (1854).

Palpi porrect, triangularly scaled, the 3rd joint hidden; maxillary palpi dilated with scales; proboscis small; frons with a rounded

Fig. 145.

Metasia monialis, ♂. ½. (From Moths Ind. vol. iv.)

prominence; antennæ nearly simple; tibiæ with the spurs equal. Fore wing rather long and narrow; vein 3 from well before angle

of cell; 7 straight and well separated from 8, 9; 10 also well separated from 8, 9. Hind wing with vein 3 from near angle of cell; 5 from above angle; 6, 7 from upper angle, 7 anastomosing with 8; median nervure somewhat pectinated above.

(1) METASIA ALBULA, n. sp.

Yellowish white; sides of palpi and head and prothorax tinged with brown; abdomen with dorsal black bands on 1st and subterminal segments. Fore wing with the costal area tinged with brown; the antemedial line represented by black points in and below cell; a prominent black spot below middle of vein 2; the postmedial line obscure, arising from a black point on costa, bent outwards between veins 5 and 2, then obsolete. Hind wing with indistinct postmedial line bent outwards between veins 5 and 2.

Hab. Amboina (*Doherty*). *Exp.* 14 mm. Types in Coll. Rothschild and B.M.

Type. (2) METASIA SUPPANDALIS Hübn. Pyr. f. 187. S. Europe; W. Asia.

(3)*METASIA HOMOGAMA Meyr. Trans. Ent. Soc. 1887, p. 239. W. Australia.

(4) METASIA CARNEALIS Tr. Schmett. Eur. vii. p. 91. S. Europe; W. Asia.

„ *gigantalis* Stgr. Hor. Ent. Ross. 1870, p. 185, pl. 2. f. 8 (var.).

(5) METASIA CORSICALIS Dup. Lép. Fr. viii. p. 306, pl. 230. ff. 6, 7. S. Europe.

Stenia infidalis H.-S. ff. 39, 40.

(6) METASIA OPHIALIS Tr. Schmett. Eur. vii. p. 90, x. 3. p. 20. S.E. Europe.

(7) METASIA SABULOSALIS Warr. A. M. N. H. (6) xviii. p. 217. W. India.

(8)†METASIA HODIUSALIS Wlk. xviii. 706. Amur; China;
Botys medialis Wlk. xxxiv. 1432. Borneo; Sumbawa.

(9) METASIA LIOPHÆA Meyr. Trans. Ent. Soc. 1887, p. 241. Australia.

(10)†METASIA PROFANALIS Wlk. xxxiv. 1403. S. Africa.

(11)†METASIA CRIOPHORA, n. sp.

♂. Frontal process large; dark fuscous; palpi white at base. Fore wing strongly irrorated with dark brown; a dark spot in middle of cell and line from median nervure to inner margin; a dark mark on discocellulars; the postmedial line excurved between veins 5 and 2, then bent inwards to below angle of cell, both wings with series of dark points on termen and cilia.

Hab. Teita, E. Africa (*Jackson*). *Exp.* 16 mm.

(12)*Metasia strangalota Meyr. Trans. Ent. Soc. 1887, p. 240.
Australia.

(13)*Metasia afrarcha Meyr. Trans. Ent. Soc. 1887, p. 239.
W. Australia.

(14)*Metasia ateloxantha Meyr. Trans. Ent. Soc. 1887, p. 242.
Australia.

(15)*Metasia hemicirca Meyr. Trans. Ent. Soc. 1887, p. 271.
Tasmania.

(16) Metasia capnochroa Meyr. Trans. Ent. Soc. 1887, p. 241.
Australia; Tasmania.

(17) Metasia homophœa Meyr. Trans. Ent. Soc. 1885, p. 449.
Australia; Tasmania.

(18)†Metasia segestusalis Wlk. xviii. 793. Australia.

(19) Metasia familiaris Meyr. Trans. Ent. Soc. 1884, p. 336.
Australia.

(20)†Metasia prionogramma Meyr. Trans. Ent. Soc. 1886, p. 265.
N. Guinea.

(21) Metasia ochrochroa Meyr. Trans. Ent. Soc. 1887, p. 238.
Australia.

(22)*Metasia xenogama Meyr. Trans. Ent. Soc. 1884, p. 337.
Australia.

(23)*Metasia zinckenialis, n. sp.

♂. Black; palpi white below; frons with white points; abdomen with white band on 1st segment, white lateral and ventral lines and patch on anal tuft. Fore wing with white basal points; a point at middle of cell with spot below it connected with inner margin by a line; a small quadrate spot in end of cell, with larger spot below end and bifid spot beyond discocellulars; an interrupted postmedial white line bent outwards between veins 5 and 2; cilia with pairs of white spots below apex and above tornus. Hind wing with white subbasal band; a quadrate spot in end of cell connected with inner margin by a band; the postmedial line represented by two points below costa and three between veins 5 and 2; cilia with white spots above and below middle.

♀. Abdomen with the white lateral and ventral lines slight. Fore wing without basal points or point in cell; the spots below cell small and without lines to inner margin; the postmedial line represented by points on costa and between median nervules. Hind wing with spot in cell and point on inner margin only.

Hab. Queensland, Dawson district (*Barnard*). *Exp.* 20 mm. Type in Coll. Rothschild.

(24)*Metasia haplodes Meyr. Trans. Ent. Soc. 1887, p. 197.
Australia.

(25) Metasia monialis Ersch, Hor. Ent. Ross. viii. p. 317, and Lep. Turc. pl. 5. f. 83. C. Asia; N. India.

(26)†METASIA HOLOXANTHIA, n. sp.

♀. Bright orange-yellow; palpi and frons fuscous, the former white below. Fore wing with the costa rufous; dark points near base and in middle of cell, and a larger discoidal spot. Hind wing with discoidal dark point; both wings with postmedial series of dark points excurved between veins 5 and 4; a terminal series of dark points on rufous marks; cilia fuscous.

Hab. Estcourt, Natal (*Hutchinson*). *Exp.* 22 mm.

Auctorum.

Metasia octogenalis Led. Wien. Ent. Mon. 1863, p. 421, pl. 15. f. 10. W. Asia.
„ *ochrifascialis* Christ. Hor. Ross. xvii. p. 121. Turkestan.
„ *ossealis* Stgr. Hor. Ross. xv. p. 182. W. Asia.
„ *mendicalis* Stgr. Hor. Ross. xv. p. 183. W. Asia.
Stenia viperalis Guen. Réunion, p. 62. Mauritius.
„ *adelalis* Guen. Delt. & Pyr. p. 245. S. France.
Metasia olbienalis Guen. Delt. & Pyr. p. 251. S. France.
„ *cuencalis* Rag. Ann. Soc. Ent. Fr. 1894, p. 171. Spain.
„ *argalis* Fern. Insect Life, vi. p. 256. California.
„ *quadristrigalis* Fern. Insect Life, vi. p. 257. California.
„ *rosealis* Rag. Bull. Soc. Ent. Fr. 1895, p. xcviii. Syria.
„ *deltoidalis* Snell. Tijd. v. Ent. xviii. p. 243, pl. xiii. f. 16. Bogota.
„ *lilliputalis* Snell. Tijd. v. Ent. xxiii. p. 229, and xxvii. pl. iii. f. 8. Celebes.
„ *acharis* Meyr. Trans. Ent. Soc. 1889, p. 518. New Guinea.
„ *inustalis* Rag. Ann. Soc. Ent. Fr. 1894, p. 169. Persia.
„ *virginalis* Rag. Ann. Soc. Ent. Fr. 1894, p. 170. Persia.
„ *ibericalis* Rag. Ann. Soc. Ent. Fr. 1894, p. 170. Spain.

Genus 146. PIONEA.

Hapalia Hübn. Verz. p. 355 (1827), non descr.
Oëbia Hübn. Verz. p. 362 (1827), non descr.
Pionea Guen. Delt. & Pyr. p. 367 (1854).
Udea Guen. Delt. & Pyr. p. 398.
Stantira Wlk. Cat. xxvii. p. 76 (1863).
Nomis Motsch. Et. 1860, p. 38.
Cindaphia Led. Wien. Ent. Mon. 1863, p. 438.
Osiriaca Wlk. xxxiv. 1493 (1865).
Perispasta Zell. Verh. z.-b. Ver. Wien, 1875, p. 331.
Pseudebulea Butl. Trans. Ent. Soc. 1881, p. 587.
Melanomecyna Butl. E. M. M. xix. p. 179 (1883).
Microstega Meyr. Trans. Ent. Soc. 1890, p. 450.
Idioblasta Warr. A. M. N. H. (6) viii. p. 62 (1891).
Aglaops Warr. A. M. N. H. (6) ix. p. 298 (1892).
Sericoplaga Warr. A. M. N. H. (6) ix. p. 296.
Prodasycnemis Warr. A. M. N. H. (6) ix. p. 301.

Mimudea Warr. A. M. N. H. (6) ix. p. 440.
Lepidoplaga Warr. A. M. N. H. (6) xvi. p. 475 (1896).

Palpi porrect, triangularly scaled, the 3rd joint concealed; maxillary palpi strongly dilated with scales at extremity; frons rounded; antennæ of male usually minutely ciliated. Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9. Hind wing with the cell short; vein 3 from angle; 4, 5 approximated for a short distance; 6, 7 stalked; 7 anastomosing with 8.

Fig. 146.

Pionea ferrugalis, ♂. ½. (From Moths Ind. vol. iv.)

Sect. I. (*Lepidoplaga*). Fore wing of male with the retinaculum consisting of a fan of large scales.

A. Fore wing of male with a fan of large scales beyond upper angle of cell at bases of veins 6, 7.

a. Fore wing of male with the fans of scales showing above as small dark foveas.

(1)†Pionea flavofimbriata Moore, Lep. Atk. p. 208.
N.E. India; Ceylon.
Crocidophora flavicinctalis Snell. Trans. Ent. Soc. 1890, p. 595.
Lepidoplaga longicorpus Warr. A. M. N. H. (6) xviii. p. 108.
„ *elongalis* Warr. A. M. N. H. (6) xviii. p. 108.

(2)*Pionea fuscizonalis Hmpsn. Moths Ind. iv. p. 428. Sikhim.

b. Fore wing of male with no foveas on upperside.

(3) Pionea phœnicistis Hmpsn. Moths Ind. iv. p. 428.
N.E. India; Burma.

B. Fore wing of male with large hyaline fovea beyond upper angle of cell, vein 7 curved down round it.

(4)†Pionea thyriphora, n. sp. (1898, Plate L. fig. 26.)

Bright orange; palpi white at base; pectus and ventral surface of abdomen whitish. Fore wing with the costal area suffused with purplish brown; the terminal area purplish. Hind wing with the costal and inner areas whitish; a purplish band on terminal area from costa to vein 2.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* 26 mm.

(5)†PIONEA ECTOXANTHIA, n. sp.

♂. Head, thorax, and abdomen pale brown; palpi white at base; sides of frons with white lines. Fore wing purplish, with flesh-coloured patches on inner area at base and beyond middle; the terminal area orange except on costa, widening from tornus to below costa. Hind wing whitish; the termen yellowish, with faint fuscous band before it.

Hab. Castro Paraña, Brazil (*Jones*). *Exp.* 22 mm.

c. Fore wing of male with no fan of scales or fovea beyond upper angle of cell.

(6)*PIONEA FLAVICILLIALIS Snell. Trans. Ent. Soc. 1890, p. 596, pl. xx. ff. 5, 5*a*. Sikhim.

(7)†PIONEA CLAVIFERA, n. sp.

♂. Head and thorax fuscous brown; abdomen paler. Fore wing with the fovea below base of cell, forming a large pouch on upperside with fan of scales above it; colour fuscous brown mixed with ochreous; the antemedial line represented by an oblique series of black points; black points at angles of cell and one above them on costa; the postmedial line arising from black point on costa, minutely waved and highly excurved from costa to vein 2, its outer edge defined by ochreous; a terminal series of points. Hind wing paler brown, with terminal series of minute dark points.

♀ with black claviform mark below cell of fore wing on outer edge of antemedial line; one specimen has the antemedial line defined by diffused white on inner side and the postmedial line placed on a diffused white area.

Hab. Australia, Peak Downs, Cooktown. *Exp.* 22 mm.

SECT. II. Fore wing of male with a large tuft of hair beyond upper angle of cell below.

(8) PIONEA NYPSIUSALIS Wlk. xix. 924. Borneo.

SECT. III. (*Perispasta*). Fore wing of male with a very large elongate hyaline fovea beyond upper angle above.

(9) PIONEA CŒCULALIS Zell. Verh. z.-b. Ver. Wien, 1875, p. 331, pl. 10. f. 46*a*. U.S.A.

†*Perispasta immixtalis* Grote, Can. Ent. xiii. p. 232.

„ *immaculalis* Grote, Smith's List Lep. Bor.-Am. p. 80.

SECT. IV. Fore wing of male with foveas below middle and in end of cell; hind tibiæ with the outer medial spur minute.

(10)*PIONEA PRAXITALIS Druce, Biol.-Centr. Am., Het. ii. p. 205, pl. 60. f. 17. Mexico; Centr. Amer.

Sect. V. Fore wing of male with a fovea covered with hair below base of median nervure above; the costa of hind wing highly arched at base.

A. (*Nomis*). Hind tibiæ of male with the outer medial spur minute.

(11) Pionea albopedalis Motschl. Études, 1860, p. 38. Japan.

B. (*Microstega*). Hind tibiæ of male with the outer medial spur half the length of inner.

(12) Pionea pandalis Hübn. Verz. p. 355. Europe; Japan.
Pyralis verbascalis Hübn. Pyr. f. 59.
„ *angustalis* Haw. Lep. Brit. p. 379.
„ *terminalis* Haw. Lep. Brit. p. 379.
†*Botys jessica* Butl. Ill. Het. ii. p. 58, pl. 39. f. 6.
† „ *protensa* Butl. Ill. Het. ii. p. 58, pl. 39. f. 7.

(13)†Pionea lutealis Warr. A. M. N. H. (6) ix. p. 439. Brazil.

(14)†Pionea cervinalis Warr. A. M. N. H. (6) ix. p. 439. Brazil.

(15)†Pionea arenacea Warr. A. M. N. H. (6) ix. p. 431. Brazil.

Sect. VI. Fore wing of male without foveas.

A. (*Prodasycnemis*). Mid tibiæ of male with large tuft of recurved hair from extremity.

(16)†Pionea inornata Butl. Ill. Het. iii. p. 76, pl. 59. f. 12. Japan.

B. (*Udea*). Hind tibiæ with the outer medial spur minute.

a. Mid tibiæ dilated with a fold and tuft.

(17) Pionea institalis Hübn. Pyr. f. 182. S. Europe.
Botys ferraralis Dup. Lép. Fr. viii. p. 317, pl. 231. f. 6.

(18) Pionea confinalis Led. Wien. Ent. Mon. 1858, p. 149, pl. 4. f. 4. E. Europe; W. Asia.
Botys græcalis Stgr. Hor. Ent. Ross. 1870, p. 199, pl. 11. f. 15.

(19) Pionea languidalis Ev. Bull. Mosc. 1842, iii. p. 559. S.E. Europe; W. Asia.
Botys arabescalis, H.-S. N. Schmett. p. 12, f. 79.

(20)* Pionea profundalis Pack. Ann. Lyc. N. Y. x. p. 261. U.S.A.

(21) Pionea fulvalis Hübn. Pyr. f. 147. Europe; C. Asia.

(22) Pionea rubigalis Guen. Delt. & Pyr. p. 398. U.S.A.
Botys oblunalis Led. Wien. Ent. Mon. 1863, p. 372.
† „ *harveyana* Grote, Can. Ent. ix. p. 104.

(23)*Pionea deidamialis Druce, Biol.-Centr. Am., Het. ii. p. 210, pl. 60. f. 27. Mexico; Centr. Amer.

(24) PIONEA FERRUGALIS Hübn. Schmett. Eur., Pyr. ff. 54, 150. Europe; W. Asia; Madeira; W. & S. Africa;
Scopula martialis Guen. Delt. & Pyr. p. 398. Japan; Afghanistan; India; Ceylon;
„ *hypatialis* Wlk. xix. 1014. Burma.
† „ *testacea* Butl. Ill. Het. iii. p. 77, pl. 59. f. 15.

(25)*PIONEA OCTONALIS Snell. Trans. Ent. Soc. 1890, p. 581. N.E. India.

(26)†PIONEA RENALIS Moore, Lep. Atk. p. 224. Sikhim.

(27)†PIONEA DELINEATALIS Wlk., Melliss's St. Helena, p. 189. St. Helena.

(28) PIONEA BLUTALIS Schiff. Wien. Verz. p. 121. Europe.
Pyralis albidalis Hübn. Pyr. f. 118.

(29) PIONEA SILVALIS Joannis, Bull. Soc. Ent. Fr. 1891, p. lxxxii; Mab. & Vuill. pl. xviii. f. 9. Syria.

(30)†PIONEA SCOPARIALIS, n. sp.

♂. Head and thorax dark olive-brown and grey; abdomen grey-white. Fore wing grey-white, thickly irrorated and suffused with grey-brown to beyond middle and on terminal area, leaving a slightly irrorated broad postmedial whitish band; an obscure antemedial waved white line curled outwards and forming a hook above inner margin; the orbicular and reniform very large, defined by black, and with black centres; a postmedial dark speck on costa, followed by an obliquely curved minutely-waved line; a terminal series of black points. Hind wing white, with black points at the two angles of cell; an indistinct curved postmedial line; an apical fuscous patch extending more or less to vein 2; a terminal series of black points; underside suffused with fuscous, with the postmedial line prominent and maculate.

Hab. Tibet, Yatong, 10,500 feet (*Hobson*). *Exp.* 24 mm.

(31) PIONEA PRUNALIS Schiff. Wien. Verz. p. 121. Europe.
Pyralis leucophœalis Hübn. Pyr. f. 77:
„ *nebulalis* Haw. Lep. Brit. p. 386.

(32) PIONEA SCORIALIS Zell. Isis, 1847, p. 566. Sicily.

(33) PIONEA SOBRINALIS Guen. Delt. & Pyr. p. 360. Brazil.
Ebulea ialis Wlk. xix. 1009.

(34)†PIONEA FUSCULALIS, n. sp.

Head and thorax brown; abdomen fuscous, with whitish segmental lines; palpi at base, pectus, and ventral surface of abdomen whitish. Fore wing brown; an antemedial waved black line obtusely angled below cell; a discoidal black lunule; a postmedial minutely-dentate black line excurved to vein 2, below which it is angled inwards almost to the cell, then bent outwards again. Hind

wing fuscous, with two black points on discocellulars; the postmedial line excurved between veins 5 and 2; both wings with terminal series of black points.

Hab. Mexico, Orizaba (*Schaus*); Peru, Callao. *Exp.* 24 mm.

(35)†Pionea olivalis Warr. A. M. N. H. (6) ix. p. 441. Brazil.

(36)†Pionea flavinotata Warr. A. M. N. H. (6) ix. p. 441. Brazil.

(37)†Pionea subrosea Warr. A. M. N. H. (6) ix. p. 441 (♀). Brazil.

(38)†Pionea phæalis, n. sp.

♂. Head and thorax dark brown and black; abdomen black, with pale segmental lines and anal tuft, the ventral surface pale with black points. Fore wing dark brown, irrorated and suffused with black; an indistinct sinuous antemedial line angled outwards below cell; obscure black annuli at middle of cell and on discocellulars; the postmedial line defined by ochreous on outer side, excurved between veins 6 and 2, then retracted to below angle of cell; some black points on costa towards apex and a terminal series of ochreous points. Hind wing fuscous, with two dark points on discocellulars; traces of a postmedial line excurved between veins 5 and 2; a terminal series of black points.

♀. Fore wing with the markings rather more distinct, with pale patches on inner area at postmedial line and on costa towards apex.

Hab. Mexico, Orizaba (*Schaus*). *Exp.* 20 mm.

(39)†Pionea stellata Butl. E. M. M. xix. p. 179. Hawaii.

(40)†Pionea nigrescens Butl. A. M. N. H. (5) vii. p. 328 (1881). Hawaii.

(41)†Pionea ennychioides Butl. A. M. N. H. (5) vii. p. 328 (1881). Hawaii.

(42)†Pionea monticolans (-ens) Butl. Trans. Ent. Soc. 1882, p. 34. Hawaii.

(43)†Pionea micacea Butl. A. M. N. H. (5) vii. p. 326 (1881). Hawaii.

b. Mid tibiæ not dilated.

(44)†Pionea antigastridia, n. sp.

♀. Ochreous; head and thorax tinged with brownish; palpi white at base. Fore wing with fiery-red streaks on the veins and in interspaces; the costal area brownish; black points at middle of cell and on discocellulars; a postmedial fuscous line with black points on the veins running out to an obtuse angle on vein 5, then incurved to middle of inner margin, and with an obscure fuscous spot beyond it on costa; cilia blackish, white at tips. Hind wing yellowish white, with a rufous mark on termen at vein 2; dark lines on termen and cilia from apex to vein 2.

Hab. Orizaba, Mexico (*Schaus*). *Exp.* 24 mm.

(45)†Pionea leucocraspia, n. sp.

♂. Bright reddish fulvous; palpi white at base. Fore wing with obscure fuscous point in cell and discoidal lunule; the post-medial line indistinct, oblique from costa to vein 5, dentate to vein 2, then bent inwards to middle of inner margin; cilia fuscous at base, white at tips. Hind wing yellowish white, with a rufous patch on termen near vein 2; dark lines on termen and through cilia from apex to vein 2.

Hab. Brazil, São Paulo (*Jones*). *Exp.* 20 mm.

(46) Pionea testacealis Zell. Isis, 1847, p. 571. S. Europe.
Botys ochrealis Dup. Lép. Fr. viii. p. 140, pl. 219. f. 1.
Ebulea rubrebralis Guen. Delt. & Pyr. p. 359.

(47) Pionea crocealis Hübn. Pyr. f. 71. Europe; W. Asia.
Pyralis ochrealis Hübn. Pyr. f. 146.

(48) Pionea lutealis Hübn. Pyr. f. 145. Europe.
Margaritia institialis Steph. Ill. iv. p. 56.
Scopula pascualis Zell. Isis, 1846, p. 206.
„ *etialis* Steph. Cat. B. M. p. 244.

(49)†Pionea gracilis Warr. P. Z. S. 1888, p. 334. N.W. India.

(50) Pionea nigrostigmalis Warr. A. M. N. H. (6) xvii. p. 96. N.E. India.

(51) Pionea inquinatalis Zell. Isis, 1846, p. 205. Labrador;
Botys glacialis Pack. Labr. xi. p. 52. Europe.

(52) Pionea stachydalis Zinck. Germ. Fn. iv. no. 18. Europe.

(53) Pionea bicoloralis Guen. Delt. & Pyr. p. 205. U.S.A.;
†*Endotricha julialis* Wlk. xvii. 389. W. Indies; S. Amer.
Cindaphia incensalis Led. Wien. Ent. Mon. 1863, p. 439, pl. 17. f. 8.
Botys facitalis Berg, Bull. Mosc. xlix. pt. 2, p. 224.
Botys amiculatalis Berg, S. E. Z. xxxvii. p. 343.
†*Pionea pulchripictalis* Hmpsn. A. M. N. H. (6) xvi. p. 341.

(54)*Pionea angustalis Feld. Reis. Nov. pl. 134. f. 26. Mexico.

C. (*Pionea*). Hind tibiæ of male with the outer medial spur well developed.

a. Mid tibiæ of male dilated with a fold and tuft.

(55) Pionea verbascalis Schiff. Wien. Verz. p. 121. Europe; W. Asia; Japan; India; Ceylon.
Pyralis arcualis Hübn. Pyr. f. 80.
Botys plumbocilialis Snell. Trans. Ent. Soc. 1890, p. 576.

(56)†Pionea poliosticta Hmpsn. Journ. Bomb. Nat. Hist. Soc. ined. Ceylon.

(57)†Pionea mandronalis Wlk. xix. 1014. India; Ceylon.

(58)†Pionea leucanalis Swinh. Trans. Ent. Soc. 1890, p. 276, pl. 8. f. 15. Assam; Burma.

(59)*Pionea genialis Leech, Entom. 1889, p. 69, pl. 3. f. 10 (♀). Japan.

(60)†Pionea albicostalis Swinh. Trans. Ent. Soc. 1890, p. 271. India; Burma.

(61)*Pionea præpandalis Snell. Trans. Ent. Soc. 1890, p. 573. Sikhim.

(62) Pionea aureolalis Led. Wien. Ent. Mon. 1863, p. 375. India; Ceylon; Burma; Andamans.
†*Pyralis ochrealis* Moore, P. Z. S. 1877, p. 614.
Paliga contractalis Warr. A. M. N. H. (6) xviii. p. 113 (1896).

(63) Pionea placens Wlk. xxxiv. 1416. Borneo.

(64)†Pionea albifimbrialis Wlk. xxxiv. 1446. China; Formosa; Sumatra; Java.
Botys niveicilialis Snell. Midd.-Sum., iv. Lep. p. 64.

(65)†Pionea minnehaha Pryer, Cist. Ent. ii. p. 234, pl. 4. f. 9. Japan; China.

(66) Pionea turiusalis Wlk. xviii. 690. Borneo.
†*Botys brœsialis* Wlk. xviii. 699.
„ *eriggusalis* Wlk. xix. 1005.

(67) Pionea lugubralis Leech, Entom. 1889, p. 67, pl. 3. f. 6 (♀). Japan.

(68)*Pionea minnithalis Druce, Biol. Centr.-Am., Het. ii. p. 242, pl. 62. f. 15. Centr. Amer.

(69)†Pionea aurora Butl. A. M. N. H. (5) vii. p. 327 (1881). Hawaii.

(70)†Pionea daiclesalis Wlk. xix. 1017. N. Zealand.

(71)†Pionea furnacalis Meyr. Trans. Ent. Soc. 1886, p. 254. Fiji.

(72) Pionea orbicentralis Christ. Bull. Mosc. lvi. (1) p. 22. Amur; Japan; N. China.

b. Mid tibiæ of male not dilated.

(73)†Pionea rhodochrysa Meyr. Trans. Ent. Soc. 1885, p. 447. Australia.

(74) Pionea rosinalis Guen. Delt. & Pyr. p. 342, pl. 9. f. 10. Brazil.

(75)†Pionea aurorina Butl. Ill. Het. ii. p. 58, pl. xxxix. f. 9. Japan.

(76)†Pionea prolausalis Wlk. xix. 990. S. Africa.

(77)†Pionea rhexialis Wlk. xviii. 624. Venezuela.

(78)†Pionea fentoni Butl. Trans. Ent. Soc. 1881, p. 587. Japan; India.

(79)†Pionea phialusalis Wlk. xix. 991. W. Africa.

(80) Pionea nobilis Moore, Lep. Atk. p. 224, pl. 7. f. 29. Sikhim.

(81) Pionea auratalis Warr. A. M. N. H. (6) xvi. p. 472 (1895). Japan.

(82)†Pionea brevialis Wlk. xviii. 759. India; Ceylon;
†*Scopula eximialis* Wlk. xxxiv. 1471. N. Australia.
Botys divisalis Led. Wien. Ent. Mon. 1863, p. 372, pl. 10. f. 4.
Mnesictena pactolina Meyr. Trans. Ent. Soc. 1887, p. 234.

(83)†Pionea externalis Warr. A. M. N. H. 1891, ii. p. 296. U.S.A.

(84) Pionea castoralis Wlk. xviii. 693. S. India; Andamans;
†*Samea purpurescens* Moore, P. Z. S. 1877, p. 615. Borneo.

(85)†Pionea ablactalis Wlk. xviii. 660. India; Ceylon; Burma; Sumbawa; Amboina.

(86)†Pionea tripartalis, n. sp.

♂. Head and thorax bright red-brown mixed with dark brown; abdomen brown mixed with grey. Fore wing bright red-brown, thickly irrorated with grey and black scales, and divided into three equal parts by oblique straight ante- and postmedial grey lines. Hind wing pale yellowish, with some darker irroration on termen and a series of dark points.

Hab. Peru. *Exp.* 26 mm.

Type. (87) Pionea forficalis Linn. Syst. Nat. x. p. 533. Europe; C. Asia; Japan; Himalayas.
† „ *sodalis* Butl. Ill. Het. ii. p. 59, pl. 39. f. 4.

(88) Pionea africalis Guen. Delt. & Pyr. p. 370, and Oberth. Et. Ent. xii. pl. vii. f. 43. Sicily; Algeria; S. Africa.
Pionea zonalis Lah. Contr. p. 20.
†*Rivula vicarialis* Wlk. xxxiv. 1155.
†*Scopula concisalis* Wlk. xxxiv. 1470.

(89)†Pionea infuscalis Zell. Caffr. p. 41. S. Africa.

(90)†Pionea inclusalis Wlk. xxxiv. 1464. W. Indies; Honduras; Venezuela.
Eurycreon fuscocilialis Snell. Tijd. v. Ent. 1875, p. 210, pl. 13. f. 1.

(91)†Pionea imitans Warr. A. M. N. H. (6) ix. p. 299 (1891). Brazil.

(92) Pionea opalisalis Guen. Delt. & Pyr. p. 172. Brazil.

(93) Pionea tæniolalis Guen. Delt. & Pyr. p. 172. Brazil.

(94)†Pionea exuvialis Guen. Delt. & Pyr. p. 172. W. Indies; Honduras; Brazil.
Botys syphaxalis Wlk. xviii. 604.

(95)†PIONEA PHÆOCHYSIS, n. sp.

♂. Head and thorax dark brown; palpi white below; abdomen fuscous, with whitish segmental lines and large genital tufts. Fore wing dull brown; a waved black antemedial line with red patch on its inner side below the cell; a dark point in cell and discoidal lunule; the area below and beyond the cell yellowish white irrorated with red, brown, and black scales; the postmedial line nearly straight, with diffused dark band on its outer side; a reddish subapical patch; a terminal series of black points. Hind wing hyaline white; a terminal fuscous band from apex to vein 2 and fine terminal line.

Hab. Ecuador, Loja. *Exp.* 24 mm.

(96) PIONEA SYLVIALIS Wlk. xviii. 615. Brazil.
Botys myopicalis Led. Wien. Ent. Mon. 1863, p. 370, pl. 8. f. 11.

(97)†PIONEA EUPALUSALIS Wlk. xviii. 605. Venezuela.

(98)†PIONEA VINOTINCTALIS Hmpsn. A. M. N. H. (6) xvi. p. 340. W. Indies.

(99)†PIONEA SERIOPUNCTALIS Hmpsn. A. M. N. H. (6) xvi. p. 341. W. Indies.

(100)†PIONEA FERRUGINEALIS Warr. A. M. N. H. (6) ix. p. 431. Brazil.

(101)*PIONEA DECETIALIS Druce, Biol. Centr.-Am., Het. ii. p. 205, pl. 60. f. 16. Centr. Amer.

(102) PIONEA NERISSALIS Wlk. xviii. 505. Brazil.
Botys graviusalis Wlk. xix. 986.
„ *nocmonalis* Wlk. xix. 987.
Scopula permixtalis Wlk. xxxiv. 1466.
†*Phlyctænia paolinalis* Warr. A. M. N. H. (6) ix. p. 431.

(103)†PIONEA TATALIS Grote, Can. Ent. ix. p. 106. U.S.A.

(104)*PIONEA DESISTALIS Wlk. Trans. Ent. Soc. (3) i. p. 126. Brazil.

(105) PIONEA RUBIGINALIS Hübn. Pyr. f. 79. Europe; W. Asia; Japan.

(106) PIONEA STAIUSALIS Wlk. xix. 945. Colombia; Brazil.
Botys scitalis Led. Wien. Ent. Mon. 1863, p. 373, pl. 10. f. 11.

(107)†PIONEA DESPECTA Butl. E. M. M. xiv. p. 49. Hawaii.
†*Scopula exigua* Butl. E. M. M. xvii. p. 9.

(108)†PIONEA HELVIUSALIS Wlk. xviii. 786. S. America.
†*Scopula itylusalis* Wlk. xviii. 787.
†*Pionea fuscipalpalis* Wlk. xxxiv. 1457.
†*Scopula bogotalis* Wlk. xxxiv. 1463.
†*Crambus bogotanellus* Wlk. xxxv. 1754.

(109)†Pionea amitina Butl. Trans. Ent. Soc. 1883, p. 54. Chili.
†*Scopula indistincta* Butl. Trans. Ent. Soc. 1883, p. 54.
† „ *melanosticta* Butl. Trans. Ent. Soc. 1883, p. 55.

(110)†Pionea sabulosalis Warr. A. M. N. H. (6) ix. p. 393. Chili.

(111)†Pionea fumipennis Warr. A. M. N. H. (6) ix. p. 392. Juan Fernandez.

(112)†Pionea dicealis Wlk. xviii. 792. Australia.

(113) Pionea numeralis Hübn. Pyr. f. 89. S. Europe; Armenia.
Scopula simplicella Lah. Contr. Faun. Sic. 51.

(114) Pionea nebulalis Hübn. Pyr. f. 51. Europe.
Pyralis squalidalis Hübn. Pyr. f. 144.
Scopula pinetalis Zett. Ins. Lapp. 970.
„ *arcticalis* Zett. Ins. Lapp. 972.
Botys pratalis Zell. S. E. Z. 1841, p. 176.

(115) Pionea decrepidalis H.-S. iv. p. 40, ff. 67, 61. Europe.

(116)†Pionea itysalis Wlk. xix. 828. U.S.A.
†*Stantira variegata* Wlk. xxvii. 76.
†*Botis turmalis* Grote, Can. Ent. xiii. p. 33.
„ *hyperborealis* Möschl. S. E. Z. xxxv. p. 163.

(117)†Pionea washingtonialis Grote, Bull. U.S. Geol. Surv. vi. p. 577. U.S.A.
Botys invinctalis Hulst, Tr. Am. Ent. Soc. xiii. p. 152.

(118)*Pionea nolalis, n. sp.

♂. White; antennæ blackish; thorax irrorated with black. Fore wing with the basal half irrorated with black, especially below costa; a black point below base of costa; an antemedial black line interrupted in cell and at vein 1; a discoidal spot; the postmedial line excurved round cell, then retracted to below it; the subterminal line slightly curved, with short lines beyond it from costa and at tornus; a prominent series of terminal points from apex to vein 2. Hind wing semihyaline, the terminal area slightly suffused with fuscous.

Hab. S. Celebes (*Doherty*). *Exp.* 20 mm. Type in Coll. Rothschild.

(119)†Pionea lacteata Warr. A. M. N. H. (6) viii. p. 62 (1891). Marquesas.

(120)†Pionea straminata Warr. A. M. N. H. (6) viii. p. 62. Marquesas.

(121) Pionea olivalis Schiff. Wien. Verz. p. 123. Europe;
Pyralis nivealis Haw. Lep. Brit. p. 385. Armenia.
„ *umbralis* Hübn. Pyr. f. 52.

(122)†Pionea indistinctalis Warr. A. M. N. H. (6) ix. p. 394. U.S.A.

(123) PIONEA CYANALIS Lah. Pyr. p. 30. Europe.

(124)†PIONEA DETERSALIS Wlk. xxxiv. 1465. Venezuela; Peru.

(125)†PIONEA MITIS Butl. Trans. Ent. Soc. 1883, p. 53. Chili.

(126)*PIONEA AUTOCLESALIS Wlk. xix. 985 (♀). Brazil.

(127)†PIONEA INHOSPITALIS Warr. A. M. N. H. (6) ix. p. 394. U.S.A.

(128)†PIONEA THYALIS Wlk. xviii. 667. China.

(129) PIONEA LEUCOSTICTALIS, n. sp.

♀. Fuscous; palpi blackish, white at base; pectus, legs, and ventral surface of abdomen white, fore tibiæ and tarsi banded with black. Fore wing with traces of antemedial line; a dark discoidal point; an indistinct postmedial line excurved from costa to vein 2, where it is retracted to below angle of cell; the outer half of costa with five very prominent pure white spots. Hind wing with indistinct postmedial line, obsolete towards costa and slightly retracted at vein 2; both wings with fine dark terminal line; cilia of hind wing white at tips.

Hab. Cooktown, Queensland (*Meek*). *Exp.* 20 mm. Types in Coll. Rothschild and B.M.

Auctorum.

Nomis tessellalis Motschl. Études, 1860, p. 38. Japan.

Scopula argyroscelis Meyr. Trans. Ent. Soc. 1888, p. 222. Hawaii.

„ *eucrena* Meyr. Trans. Ent. Soc. 1888, p. 218. Hawaii.

Pionea conquisitalis Guen. Alg. iii. p. 403, pl. 4. f. 9. Algeria.

Botys assutalis Led. Wien. Ent. Mon. 1863, p. 370, pl. 8. f. 14. Venezuela.

„ *subochracealis* Pag. J.B. Nass. Ver. 1884, p. 268. Amboina.

„ *integralis* Led. Wien. Ent. Mon. 1863, p. 373, pl. 10. f. 12. Venezuela.

„ *tritalis* Christ. Bull. Mosc. lvi. (1) p. 20. Amur; N. China.

Scopula illutalis Guen. Delt. & Pyr. p. 400 = *dilutalis* Guen. Algeria, p. 401, pl. 4. f. 6; Oberth. Et. Ent. xii. pl. vii. f. 45. Algeria.

„ *dispunctalis* Guen. Delt. & Pyr. p. 396 = *bipunctalis* H.-S. ff. 140, 141. S. Europe; Armenia.

Botys costalis Ev. Bull. Mosc. 1852, p. 166 = *hilaralis* Christ. Bull. Mosc. lvi. (1) p. 23. Siberia.

„ *perochrealis* Christ. Rom. Mém. iii. p. 35, pl. ii. f. 6. Armenia.

„ *varialis* Brem. Mém. Acad. St. Pétersb. viii. p. 69, pl. 6. f. 9. Siberia.

Scopula concoloralis Oberth. Et. Ent. i. p. 68, pl. 2. f. 6. Algeria.

Cindaphia impuralis Snell. Tijd. v. Ent. xviii. p. 264, pl. xiv. f. 10. W. Indies.

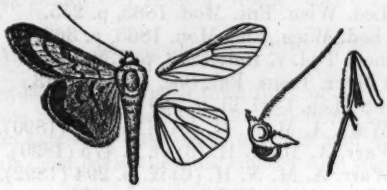
Pionea terminalis Mab. Ann. Soc. Ent. Fr. (5) ix. p. 338. Madagascar.

Genus 147. Paratalanta.

Paratalanta Meyr. Trans. Ent. Soc. 1890, p. 440.

Palpi porrect, extending about the length of head, triangularly scaled; the 3rd joint hidden with hair; maxillary palpi almost filiform; frons rounded; antennæ of male ciliated; mid tibiæ dilated with a fold containing a tuft of long hair and a fringe of scales; hind tibiæ with the outer spurs half the length of inner. Fore wing of male very long and narrow, the outer margin oblique, a strong costal fold on basal half; vein 3 from before angle of cell; 4, 5 separate; 7 curved and approximated to 8, 9. Hind wing of male with the outer margin somewhat excised from vein 3 to near anal angle, which is lobed; the cell short; veins 3, 4, 5 from close to angle; 6, 7 shortly stalked, 7 anastomosing with 8.

Fig. 147.



Paratalanta ussurialis, ♂. ½.

Type. Paratalanta ussurialis Brem. Lep. Ost-Sib. p. 68, pl. 6. f. 6. Siberia; China; Japan.

Botys cultralis Staud. S. E. Z. 1867, p. 108.

„ *labutonalis* Led. Hor. Ent. Ross. 1871, pl. ii. f. 9.

„ *amurensis* Rom. Mém. iii. p. 32.

Genus 148. Aplectropus.

Aplectropus Hmpsn. P. Z. S. 1896, p. 275.

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi filiform; frons rounded; antennæ ciliated; tibiæ without spurs. Fore wing with veins 3, 4, 5 well separated at origin; 7 straight and well separated from 8, 9. Hind wing with veins 3, 4, 5 well separated at origin; 6, 7 stalked, 7 anastomosing with 8 to near apex.

Fig. 148.

Aplectropus leucopis, ♂. ½.

Type. †Aplectropus leucopis Hmpsn. P. Z. S. 1896, p. 275, pl. 10. f. 10. Aden.

Genus 149. Pyrausta.

Pyrausta Schrank, Faun. Boica, ii. 2, p. 163 (1802).
Syllythria Hübn. Verz. p. 349 (1827).
Hæmatia Hübn. Verz. p. 349.
Epicorsia Hübn. Verz. p. 355.
Hapalia Hübn. Verz. p. 355.
Anania Hübn. Verz. p. 360.
Ostrinia Hübn. Verz. p. 360.
Hercyna Tr. Schmett. Eur. vii. p. 179 (1829).
Boreophila Guen. Dup. Cat. Méth. p. 195 (1831).
Nascia Curt. Brit. Ent. vi. p. 599 (1840).
Herbula Guen. Delt. & Pyr. p. 175 (1854).
Synchromia Guen. Delt. & Pyr. p. 288.
Enulea Guen. Delt. & Pyr. p. 357.
Sebunta, Wlk. xxvii. p. 77 (1863).
Ennychia Led. Wien. Ent. Mon. 1863, p. 255.
Algedonia Led. Wien. Ent. Mon. 1863, p. 363.
Gyptitia Snell. Tijd. v. Ent. 1883, p. 138.
Eclipsiodes Meyr. Trans. Ent. Soc. 1884, p. 343.
Paliga Moore, Lep. Ceyl. iii. p. 350 (1885).
Opsibotys Warr. A. M. N. H. (6) vi. p. 474 (1890).
Sciorista Warr. A. M. N. H. (6) vi. p. 475 (1890).
Micractis Warr. A. M. N. H. (6) ix. p. 294 (1892).
Glauconoë Warr. A. M. N. H. (6) ix. p. 296.
Anthocrypta Warr. A. M. N. H. (6) ix. p. 296.
Aplographe Warr. A. M. N. H. (6) ix. p. 301.
Diacme Warr. A. M. N. H. (6) ix. p. 389.
Niphograpta Warr. A. M. N. H. (6) ix. p. 390.
Cosmocreon Warr. A. M. N. H. (6) ix. p. 433.
Ebuleodes Warr. A. M. N. H. (6) xviii. p. 112 (1896).
Placosaris Meyr. Trans. Ent. Soc. 1897, p. 89.

Palpi porrect, triangularly scaled, the 3rd joint hidden by hair; maxillary palpi almost filiform; frons rounded; antennæ about three-fourths length of fore wing and ciliated; tibiæ with the outer spurs short, the outer medial spur not more than two-thirds

Fig. 149.

Pyrausta coclesalis, ♂. ½. (From Moths Ind. vol. iv.)

length of inner. Fore wing with veins 3, 4, 5 from angle of cell; 7 nearly straight; 10 sometimes anastomosing shortly with 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 from upper angle, 7 anastomosing with 8.

Sect. I. (*Gyptitia*). Antennæ of male with a small tooth on inner side of 3rd joint; hind wing with the bases of vein 1 *c* and median nervure fringed with long hair below.

(1)†Pyrausta ochracealis Wlk. xxxiv. 1446. Assam; Ceylon; Burma; Java; Celebes.

Gyptitia gonialis Snell. Tijd. v. Ent. 1883, p. 138, pl. 8. f. 9 *a*, *b*.

†*Hapalia denticulosa* Moore, Lep. Ceyl. iii. p. 337, pl. 183. f. 8.

Sect. II. Antennæ of male with a tuft of hair on inner side of basal joint; the base of shaft excised, flattened and contorted.

(2)*Pyrausta torridalis Hmpsn. Moths Ind. iv. p. 443. Assam.

Sect. III. Antennæ of male normal.

A. Fore legs of male with thick tufts of fawn-coloured hair from base of coxæ and white hair from their extremities; mid legs with large tufts of black and white spatulate hair from coxæ, the tibiæ clothed with rough hair.

(3)†Pyrausta bambucivora Moore, Lep. Atk. p. 224. India; Ceylon.

†*Nascia arenalis* Hmpsn. Ill. Het. ix. p. 163, pl. 173. f. 29.

(4)†Pyrausta citrinalis Warr. A. M. N. H. (6) ix. p. 302 (♀). N.W. Himalayas.

B. Hind tibiæ of male with the outer medial spur minute.

a. Fore wing of male with large fovea below the cell.

(5) Pyrausta xanthothysana, n. sp.

Reddish brown with a cupreous tinge; palpi below, front of pectus, and mid tibiæ and tarsi white, fore tibiæ with white bands. Fore wing with oblique sinuous dark antemedial line; a speck in cell and discocellular lunule; a highly dentate postmedial line slightly bent outwards between veins 7 and 2, then retracted; a terminal series of black points; the cilia yellow. Hind wing with minutely dentate postmedial line; a terminal series of points, becoming a line towards tornus; cilia yellow.

Hab. Sikhim. *Exp.* 36 mm. Types in Coll. Rothschild and B.M.

b. (*Placosaris*). Fore wing of male with scale-fans below median nervure on upper and under sides.

(6)†Pyrausta leucula Meyr. Trans. Ent. Soc. 1897, p. 89 Sangir.

c. (*Nascia*). Fore wing of male without scale-fans.

(7) PYRAUSTA CILIALIS Hübn. Schmett. Eur., Pyr. f. 119. Europe; Amur.
Botys venosalis Nolck. Nat. Ver. Riga, 1848, i. p. 283.
„ *virgata* Reulti, Lep. Fri. 139.
Antigastra virgatalis Christ. Bull. Mosc. lvi. (1) p. 38.

(8)†PYRAUSTA ACUTELLA Wlk. xxxv. 1753. U.S.A.
†*Botys venalis* Grote, Can. Ent. x. p. 24.

(9) PYRAUSTA FUMALIS Guen. Delt. & Pyr. p. 358. U.S.A.
†*Scopula orasusalis* Wlk. xviii. 784.
†*Botis badipennis* Grote, Bull. Buff. Soc. i. p. 88, pl. 2. f. 12.

(10) PYRAUSTA RUBELLALIS Snell. Trans. Ent. Soc. 1890, p. 577. N.E. India; Burma.
Botys coactalis Snell. Trans. Ent. Soc. 1890, p. 577.

(11)†PYRAUSTA BISIGNATA Butl. Ill. Het. vii. p. 98, pl. 135. f. 11. N.W. Himalaya.

(12) PYRAUSTA PAUPELLALIS Led. Wien. Ent. Mon. 1863, p. 469, pl. 10. f. 6. India; Ceylon.

(13) PYRAUSTA OBLIQUATA Moore, Lep. Atk. p. 224. India; Ceylon; Burma.
† „ *nissoralis* Swinh. A. M. N. H. (6) xiv. p. 145.

(14)*PYRAUSTA CYNOALIS Druce, Biol. Centr.-Am., Het. ii. p. 221, pl. 61. f. 11. Mexico; Centr. Am.

(15)*PYRAUSTA SIMPLEX Warr. A. M. N. H. (6) xviii. p. 112. Assam.

(16)*PYRAUSTA IMPUNCTATA Warr. Nov. Zool. iv. p. 129. Natal.

(17)†PYRAUSTA COCLESALIS Wlk. xviii. 701. Japan;
†*Botys itemasalis* Wlk. xix. 996. Oriental region.
† „ *strenualis* Wlk. xxxiv. 1409.
† „ *interfusalis* Wlk. xxxiv. 1443.
„ *lentalis* Feld. Reis. Nov. pl. 135. f. 44.
„ *lacrimalis* Leech, Ent. xxii. p. 69, pl. iii. f. 12.

(18)†PYRAUSTA ACUTIDENTALIS Hmpsn. Moths Ind. iv. p. 441 (♀). Sikhim.

(19) PYRAUSTA FRAUDULENTALIS Warr. A. M. N. H. (6) xvi. p. 474. Assam.

(20)†PYRAUSTA BAMBUSALIS Moore, Lep. Atk. p. 222. N.E. India.

(21) PYRAUSTA DINIASALIS Wlk. xviii. 649. China; N.W. Himalayas.

(22) PYRAUSTA FUSCALIS Schiff. Wien. Verz. p. 121. Europe.
Pyralis cinerealis Fabr. Ent. Syst. no. 379.
Margaritia pulveralis Steph. Ill. iv. p. 56.
„ *fimbrialis* Steph. Ill. iv. p. 56.
Pyralis julialis Schrank, Faun. Boica, p. 1712.

(23) PYRAUSTA TERREALIS Tr. Schmett. Eur. vii. p. 110. U.S.A.; Europe; Afghanistan.
Scopula borealis Curt. Brit. Ent. 175.
†*Botys mysippusalis* Wlk. xviii. 564.
„ *humilalis* Led. Wien. Ent. Mon. 1863, p. 371, pl. 9. f. 2.

(24)†PYRAUSTA ACCOLALIS Zell. S. E. Z. 1867, p. 190. S.E. Europe.

(25) PYRAUSTA SAMBUCALIS Schiff. Wien. Verz. p. 121. Europe.

(26) PYRAUSTA TERTIALIS Guen. Delt. & Pyr. p. 364. U.S.A.
Botys plectilis Grote & Rob. Trans. Am. Ent. Soc. i. p. 20, pl. 2. f. 17.
„ *syringicola* Pack. Rep. Mass. Board Agric. 1870.

(27)*PYRAUSTA TRIUMPHALIS Feld. Reis. Nov. pl. 135. f. 47. Bogota.

(28) PYRAUSTA LUCTUALIS Hübn. Pyr. f. 88. Europe; Amur; Japan.
Noctua unigutta Esp. iv. p. 104, pl. 183. ff. 1, 2.
†*Ennychia diversa* Butl. Trans. Ent. Soc. 1884, p. 585.

(29)†PYRAUSTA SUFFUSALIS Warr. A. M. N. H. (6) ix. p. 438 (♀). Japan.

C. Mid tibiæ of male immensely dilated with a fold and tuft of hair; hind tibiæ with the outer medial spur one-third length of inner.

(30) PYRAUSTA MELLINALIS Hübn. Zutr. i. 24, 69. ff. 137, 138. U.S.A.; W. Indies; S. America
Botys œdipodalis Guen. Delt. & Pyr. p. 336.
† „ *butyrosa* Butl. P. Z. S. 1878, p. 493.
Eudioptis oratalis Hulst, Tr. Am. Ent. Soc. xiii. p. 158.

(31)†PYRAUSTA FLAVIDENSALIS Warr. Trans. Ent. Soc. 1889, p. 287 (palpi broken). Brazil.

D. Mid tibiæ of male immensely dilated with a thick fringe of large curved scales on inner side.

(32) PYRAUSTA VARIALIS Brem. Lep. Ost-Sib. p. 69, pl. vi. f. 9. Siberia; Japan.
†*Opsibotys latipennis* Warr. A. M. N. H. (6) ix. p. 295 (1892).

E. Legs of male normal; the outer medial spur about one-half length of inner.

a. (*Crypsiptya*). Thorax of male with a large fan of scales at base of fore wing below.

(33)†PYRAUSTA CEADESALIS Wlk. xviii. 639. W. & E. Africa.

(34)†PYRAUSTA DEDUCTALIS Wlk. xviii. 659; Hmpsn. Ill. Het. ix. pl. 183. f. 8. India; Ceylon; Malayan subregion to New Guinea.
Botys neridalis Led. Wien. Ent. Mon. 1863, p. 371, pl. 9. f. 7.
„ *ausonialis* Snell. Trans. Ent. Soc. 1890, p. 578.
†*Glauconoë fuscescens* Warr. A. M. N. H. (6) ix. p. 297 (1892).

b. Thorax of male normal.

a'. Fore wing of male with a glandular swelling on costa at two-thirds from base; a hyaline fovea in end of cell; vein 7 from well below upper angle, 6 from below middle of discocellulars, the base of each curved downwards and with elongate foveas above them.

(35)†PYRAUSTA FOVIFERALIS Hmpsn. Moths Ind. iv. p. 439. Burma.

b'. (*Anthocrypta*). Hind wing of male with a large patch of androconia from below middle of cell to near outer margin.

(36) PYRAUSTA SUBINQUINALIS Guen. Delt. & Pyr. p. 362. Brazil.

c'. Wings of male normal.

(37)†PYRAUSTA PERELEGANS, n. sp. (1898, Plate L. fig. 29.)

♂. Head, thorax, and abdomen above purplish, the last tinged with black; pectus and ventral surface of abdomen white; wings very pale hyaline yellow. Fore wing with the costa bright purple, expanding to inner margin at base, slightly at middle, into a truncate triangular discoidal patch with a yellow point on it, and into an apical patch extending to vein 5 and bearing two yellow spots and a fine terminal line; a very indistinct dentate line from lower edge of apical patch to vein 2 near cell and angled outwards above vein 1; some purple points on termen. Hind wing with discoidal point and irregularly waved postmedial indistinct fuscous line bent outwards between veins 5 and 3; some purple points on termen.
Hab. Colombia; Peru. *Exp.* 28 mm.

(38) PYRAUSTA CINIFERALIS Wlk. xxxix. 1417. Ceylon; Burma; Borneo.
†*Hapalia concolor* Moore, Lep. Ceyl. iii. p. 339, pl. 181. f. 3.

(39)†PYRAUSTA SUBFLAVALIS Warr. A. M. N. H. (6) ix. p. 297 (1892). Madagascar.

(40)†PYRAUSTA ALBICERALIS Grote, Bull. U.S. Geol. Surv. iv. p. 678. U.S.A.

(41)†PYRAUSTA ALLECTALIS Grote, Can. Ent. ix. p. 107. U.S.A.
Eurycreon perplexalis Fern. Can. Ent. xvii. p. 57.

(42)†PYRAUSTA VACUNALIS Grote, Can. Ent. xiii. p. 33. U.S.A.

(43) PYRAUSTA RHIPHEUSALIS Wlk. xviii. 710. Borneo; Solomons.

(44) PYRAUSTA INCOLORALIS Guen. Delt. & Pyr. p. 333. Syria; W. & S. Africa;
†*Botys melonalis* Wlk. xviii. 702. Aden; India;
†*Spilodes nitetesalis* Wlk. xviii. 773. Malayan subregion
†*Botys albidalis* Wlk. xxxiv. 1411. to Australia.
„ *ruficostalis* Led. Verh. z.-b. Wien, 1855, p. 217, pl. 3. f. 4.

(45) PYRAUSTA REPANDALIS Schiff. Wien. Verz. p. 120. Europe.
Pyralis pallidalis Hübn. Pyr. f. 115.

(46) PYRAUSTA PERLUCIDALIS Hübn. Pyr. f. 143. Europe.
Botys commellalis Chrét. Le Nat. 1891, p. 99.

(47) PYRAUSTA PERTEXTALIS Led. Wien. Ent. Mon. 1863, p. 371, pl. 9. f. 10. U.S.A.
Botis gentilis Grote, Bull. Buff. Soc. i. p. 173.
„ *thesealis* Zell. Verh. z.-b. Wien, 1872, p. 514.

(48)†PYRAUSTA FISSALIS Grote, Bull. U.S. Geol. Surv. vi. p. 273. U.S.A.

(49) PYRAUSTA MODERATALIS Christ. Bull. Mosc. lvi. (1) p. 25. Japan.

(50)†PYRAUSTA ÆGLEALIS Wlk. xviii. 565. U.S.A.
†*Botis quinquelinealis* Grote, Bull. Buff. Soc. Nat. Sci. ii. p. 231.

(51)†PYRAUSTA THESTEALIS Wlk. xviii. 733. U.S.A.
†*Botis magistralis* Grote, Bull. Buff. Soc. Nat. Sci. i. p. 173.
„ *gulosalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 155.

(52)†PYRAUSTA THESEUSALIS Wlk. xviii. 562. U.S.A.
†*Botis feudalis* Grote, Bull. Buff. Soc. Nat. Sci. ii. p. 21.

(53)†PYRAUSTA LANGDONALIS Grote, Can. Ent. ix. p. 10. U.S.A.

(54) PYRAUSTA OXYDALIS Guen. Delt. & Pyr. p. 328. U.S.A.; Brazil.

(55) PYRAUSTA FLAVIDALIS Guen. Delt. & Pyr. p. 329. U.S.A.
†*Botys lacoalis* Wlk. xviii. 733.
† „ *cinctipedalis* Wlk. xxxiv. 1391.

(56) PYRAUSTA PUNCTIMARGINALIS Hmpsn. Moths Ind. iv. p. 438. Sikhim.

(57) PYRAUSTA FLAVALIS Schiff. Wien. Verz. p. 121. Europe.
Botys lutealis Dup. Lép. Fr. viii. p. 331, pl. 233. f. 1 (var.).
„ *citralis* H.-S. iv. p. 28.

(58)†PYRAUSTA PROCILLUSALIS Wlk. xviii. 641. S. Africa.
†*Botys flavissimalis* Wlk. xxxiv. 1402.

(59) PYRAUSTA TRINALIS Schiff. Wien. Verz. p. 317. Europe;
„ *flavalis* v. *tripunctalis* Oberth. Bull. C. Asia.
Soc. Ent. Fr. (6) vii. p. xcix.

(60)†PYRAUSTA SIGNATALIS Wlk. xxxiv. 1444. India; Ceylon; Java.

(61)†PYRAUSTA GRACILIS Butl. Ill. Het. iii. p. 74, pl. 59. f. 4.
Botys explicatalis Christ. Bull. Mosc. 1881, i. p. 16. Japan.

(62)†PYRAUSTA PHYLLISALIS Wlk. xix. 936. U.S.A.

(63) PYRAUSTA LIPARALIS Guen. Delt. & Pyr. p. 195. Brazil.
Botys catonalis Wlk. xix. 936.

(64)†PYRAUSTA ELEALIS Wlk. xvii. 351. U.S.A.
†*Botys tædialis* Wlk. xviii. 732.

(65) PYRAUSTA ADIPALOIDES Grote & Rob. Tr. Am. Ent. Soc. i. p. 27, pl. 2. f. 19. U.S.A.

(66) PYRAUSTA MOPSALIS Wlk. xviii. 594. Venezuela.
Botys mettiusalis Wlk. xviii. 731.

(67)†PYRAUSTA ALBIGUTTALIS Warr. Trans. Ent. Soc. 1889, p. 289. Brazil.

(68) PYRAUSTA ORIOLALIS Guen. Delt. & Pyr. p. 196. Brazil.
Botys finitalis Guen. Delt. & Pyr. p. 335.

(69) PYRAUSTA BITERNALIS Mann. Wien. Ent. Mon. 1862, p. 185, pl. 3. f. 7. Armenia.

(70) †PYRAUSTA FUSCIMACULALIS Grote, Can. Ent. x. p. 25. U.S.A.
†*Botys confovealis* Hulst, Tr. Am. Ent. Soc. xiii. p. 151.

(71)†PYRAUSTA SUBMEDIALIS Grote, Can. Ent. viii. p. 111. Canada;
†*Botis dissectalis* Grote, Can. Ent. xii. p. 36. U.S.A.
„ *pilalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 151.

(72)†PYRAUSTA TRIMACULALIS Grote, Can. Ent. x. p. 24. U.S.A.

(73) PYRAUSTA PRÆPETALIS Led. Hor. Ent. Ross. 1869, p. 90, pl. 5. f. 11. Armenia; Centr. Asia.

(74) PYRAUSTA LUTULENTALIS Led. Wien. Ent. Mon. 1858, p. 149. f. 4. Syria.

(75)†PYRAUSTA AUREA Butl. A. M. N. H. (4) xvi. p. 414 (1875). Natal.

(76)†PYRAUSTA FLAVICOLORALIS Grote, Can. Ent. x. p. 25. U.S.A.

(77)†PYRAUSTA THALESALIS Wlk. xviii. 599. Honduras.

(78)*PYRAUSTA ILLUTALIS Guen. Delt. & Pyr. p. 333. Brazil.

(79) PYRAUSTA EXTRICALIS Guen. Delt. & Pyr. p. 338. Canada;
†*Pionea dionalis* Wlk. xviii. 758. U.S.A.
†*Spilodes nisæcalis* Wlk. xviii. 771.
Botys intricatalis Led. Wien. Ent. Mon. 1863, p. 373, pl. 10. f. 9.
† „ *oppilalis* Grote, Can. Ent. xii. p. 36.

(80)†PYRAUSTA HELVALIS Wlk. xviii. 757. U.S.A.
†*Botis oscitalis* Grote, Can. Ent. xii. p. 36.
„ *gyralis* Hulst, Tr. Am. Ent. Soc. xiii. p. 152.

(81)†PYRAUSTA SANGUINEALIS Warr. A. M. N. H. (6) ix. p. 294 (1892). Japan.

(82) PYRAUSTA SALENTIALIS Snell. Tijd. v. Ent. 1880, p. 207, & 1883, pl. 7. f. 1. Java; Celebes; Flores; Australia.

(83) PYRAUSTA FURNACALIS Guen. Delt. & Pyr. p. 332. Australia.

(84)†PYRAUSTA DAMOALIS Wlk. xviii. 656. Japan; China;
†*Botis scapulalis* Wlk. xviii. 657. Himalayas; Burma.
Hapalia dorsivittata Moore, Lep. Atk. p. 223, pl. 7. f. 18.

(85) PYRAUSTA NUBILALIS Hübn. Samml. Eur. Schmett., Pyr. f. 94. Europe; W. Asia; Himalayas; Assam.
Pyralis silacealis Hübn. Samml. Eur. Schmett., Pyr. f. 116.
„ *glabralis* Haw. Lep. Brit. p. 380.
Botys zealis Guen. Delt. & Pyr. p. 332.
Hapalia kasmirica Moore, Lep. Atk. p. 222, pl. 7. f. 28.

(86)†PYRAUSTA INDISTANS Moore, Lep. Atk. p. 223. Himalayas.
Botys callidoralis Oberth. Et. Ent. xv. p. 25, pl. iii. f. 30.

(87)†PYRAUSTA GRISEIFUSA Swinh. Trans. Ent. Soc. 1891, p. 153. S. India.

(88)†PYRAUSTA OCCULTILINEA Wlk. xxvii. 168. N.E. India; Borneo.

(89) PYRAUSTA OBUMBRATALIS Led. Wien. Ent. Mon. 1863, p. 372, pl. 9. f. 7. U.S.A.

(90) PYRAUSTA ROBUSTA Moore, Lep. Atk. p. 222, pl. 7. f. 27 (♀). Sikhim.

(91) PYRAUSTA MUSTELINALIS Pack. Ann. Lyc. N.Y. x. p. 262.
†*Botis catenulalis* Grote, Can. Ent. ix. p. 105. U.S.A.
„ *monulalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 154.

(92) PYRAUSTA CLAUDIUSALIS Wlk. xviii. 629. U.S.A.

(93) PYRAUSTA SINGULARIS Led. Wien. Ent. Mon. 1863, p. 376, pl. 12. f. 1. U.S.A.; Brazil.

(94)†PYRAUSTA RUBIDALIS Dognin, Ann. Soc. Ent. Belge, xli. p. 249 (1897). (1898, Plate L. fig. 30[1].) Ecuador.

[1] Named *egcersialis* in the Explanation of the Plate.

(95)†PYRAUSTA GLAUCESCENS, n. sp.

♂. Head and thorax reddish brown suffused with grey; abdomen ochreous tinged with fuscous. Fore wing rufous suffused with grey, especially on inner and apical areas; the antemedial black line very indistinct, strongly angled below the cell and with a prominent spot on inner margin; a prominent white, discoidal spot; an obliquely curved postmedial series of black points on a broad band of grey suffusion. Hind wing white, with subterminal black points on veins 2 to 6, some brown suffusion on termen from apex to vein 2.

Hab. Ecuador. *Exp.* 34 mm.

(96) PYRAUSTA ILLIBALIS Hübn. Zutr. i. 19, 48. ff. 95, 96.
†*Botys arsaltealis* Wlk. xvii. 564. Canada; U.S.A.
† „ *euphœsalis* Wlk. xix. 1008.
†*Sebunta guttulosa* Wlk. xxvii. 78.
Scoparia fascialis Wlk. Trans. Ent. Soc. (3) i. p. 127.
Botys subjectalis Led. Wien. Ent. Mon. 1863, p. 374, pl. 10. f. 13.
„ *magniferalis* Wlk. Can. Nat. & Geol. vi. p. 41.

(97) PYRAUSTA INCONCINNALIS Led. Wien. Ent. Mon. 1863, p. 372, pl. 10. f. 2. U.S.A.
†*Botis crocatalis* Grote, Papilio, i. p. 167.
„ *festalis*, Hulst, Tr. Am. Ent. Soc. xiii. p. 153.

(98) PYRAUSTA FUTILALIS Led. Wien. Ent. Mon. 1863, p. 372, pl. 10. f. 1. U.S.A.
†*Botis erectalis* Grote, Can. Ent. viii. p. 99.

(99) PYRAUSTA FUMOFERALIS Hulst, Tr. Am. Ent. Soc. xiii. p. 154. U.S.A.

(100) PYRAUSTA SUBSEQUALIS H.-S. Schmett. Eur. vi. p. 141, f. 133. Armenia.

(101) PYRAUSTA ASINALIS Hübn. Pyr. f. 185. Europe.
Botys characteralis Frr. vi. p. 67, f. 521.

(102) PYRAUSTA ERIOPSALIS Wlk. xix. 1006. Assam; Borneo.
Glauconoë atrigenalis Warr. A. M. N. H. (6) xvii. p. 95 (1896).

(103)*PYRAUSTA CURVALIS Leech, Ent. xxii. p. 68, pl. iii. f. 3. Japan.

(104) PYRAUSTA VITELLINALIS Koll. Hüg. Kash. iv. p. 492. Himalayas; Burma.
Botys extinctalis Led. Wien. Ent. Mon. 1863, p. 467, pl. ix. f. 18.

(105)†PYRAUSTA USTALIS Hmpsn. Ill. Het. viii. p. 138, pl. 155. f. 7. S. India.

(106) PYRAUSTA PROFUSALIS Warr. A. M. N. H. (6) xvii. p. 95. N.E. India; Ceylon; Burma

(107) PYRAUSTA DIFFUSALIS Guen. Delt. & Pyr. p. 340.
S. Europe; Syria; N.W. India.
Botys affusalis Guen. Delt. & Pyr. p. 340.
„ *carnealis* Dup. Lép. Fr. viii. p. 322, pl. 232. f. 4 (*nec* Tr.).
„ *tenuialis* Mann. Wien. Ent. Mon. 1862, p. 387, pl. 3. f. 5.

(108)†PYRAUSTA PHARISALIS Wlk. xviii. p. 726. Australia.

(109)*PYRAUSTA MALEDICTALIS, n. n.
Pyrausta fuscalis Warr. A. M. N. H. (6) xviii. p. 217 (preocc.). W. India.

(110)†PYRAUSTA COORUMBA Hmpsn. Ill. Het. viii. p. 132, pl. 154. f. 13. Assam; S. India.
Ebulea anomalalis Warr. A. M. N. H. (6) xviii. p. 110.

(111)†PYRAUSTA TINCTALIS Hmpsn. Ill. Het. viii. p. 132, pl. 154. f. 6. S. India.

(112)†PYRAUSTA PURPURASCENS Hmpsn. Ill. Het. ix. p. 162, pl. 172. f. 14. Ceylon.

(113)†PYRAUSTA BENENOTATA Swinh. A. M. N. H. (6) xiv. p. 142. N.E. India.

(114)*PYRAUSTA TRIPLAGALIS Warr. A. M. N. H. (6) xviii. p. 114 (♀). Assam.

(115)†PYRAUSTA NIGRESCENS Moore, Lep. Atk. p. 221. Sikhim.

(116)*PYRAUSTA NIGRITALIS Hmpsn. Moths Ind. iv. p. 434. Bum a.

(117) PYRAUSTA LIMBOPUNCTALIS H.-S. iv. p. 115, f. 117.
S. Europe; W. & C. Asia.
Herbula sardinialis Guen. Delt. & Pyr. p. 178, pl. 4. f. 5.
„ *congeneralis* Guen. Delt. & Pyr. p. 179.
Botys frustalis H.-S. N. Schmett. f. 144.
„ *dissolutalis* Staud. Hor. Ent. Ross. xv. p. 171 (var.).

(118) PYRAUSTA AEREALIS Hübn. Pyr. f. 44.
Europe; W. & C. Asia.
Pyralis opacalis Hübn. Pyr. ff. 169, 170.
Pyrausta suffusalis Tr. Schmett. Eur. vii. p. 68.
Scopula ablutalis Ev. F. V. & U. 461 (var.).

(119) PYRAUSTA SUBOLIVALIS Pack. Ann. Lyc. N. York, x. p. 261. U.S.A.
Botys unifascialis Pack. Ann. Lyc. N. York, x. p. 261.
Botis hercynalis Grote, Bull. Buff. Soc. ii. p. 232.
„ *obnigralis* Hulst, Tr. Am. Ent. Soc. xiii. p. 153.

(120)†PYRAUSTA CANOTINCTALIS Hmpsn. Moths Ind. iv. p. 431. N.W. Himalayas.

(121) PYRAUSTA TORVALIS Möschl. Wien. Ent. Mon. 1864, p. 198, pl. 5. f. 16. Labrador.
†*Scoparia gelida* McLachl. Journ. Linn. Soc. xiv. p. 115.

(122) PYRAUSTA MURINALIS F. R. p. 276, pl. 92. f. 3. Europe.

(123) PYRAUSTA AUSTRIACALIS H.-S. vi. p. 141, f. 142. Europe.
Scopula donzelalis Guen. Delt. & Pyr. p. 392, pl. 6. f. 12.
Botys sororialis Heyd. Jahrb. Graub. 1860, & S. E. Z. 1862 (var.).
„ *nitidalis*, Heinem. Schmett. Deutschl. p. 83 (var.).

(124) PYRAUSTA ULIGINOSALIS Steph. Cat. 166. Europe.
Botys monticolalis Lah. Pyr. 26.

(125) PYRAUSTA ALPINALIS Schiff. Wien. Verz. p. 123. Europe.

(126)*PYRAUSTA DEVIALIS Feld. Reis. Nov. pl. 135. f. 21. Bogota.

(127) PYRAUSTA RHODODENDRALIS Dup. Lép. Fr. viii. p. 363, pl. 235. f. 5. Europe.
Tortrix sulphurana Hübn. 162.

(128) PYRAUSTA FODINALIS Led. Wien. Ent. Mon. 1863, p. 369, pl. 8. f. 9. U.S.A.
†*Botis socialis* Grote, Can. Ent. ix. 107.

(129) PYRAUSTA SEMIRUBRALIS Pack. Ann. N. Y. Lyc. x. (1873) p. 263. U.S.A.

(130) PYRAUSTA PERRUBRALIS Pack. Ann. N. Y. Lyc. x. p. 265. U.S.A.

(131)†PYRAUSTA POSTRUBRALIS, n. sp.

Head and thorax bright yellow; palpi brownish, white at base; frons and shoulders pink; abdomen yellowish white. Fore wing bright yellow; a pink fascia below basal half of costa; a pink antemedial line angled below cell, then obsolescent; a large pink discoidal spot extending to costa and connected at lower end with the broad oblique pink postmedial band, which is angled inwards to costa on inner side and extends to apex on outer. Hind wing yellowish white; a subterminal fuscous band from costa to vein 2, towards which it becomes pinkish.

Hab. Mexico, Arizona (*Schaus*). *Exp.* 24 mm.

(132)*PYRAUSTA PERFULVALIS, n. sp.

♀. Bright fulvous; palpi white below; abdomen with slight fuscous segmental lines. Fore wing slightly irrorated with fuscous; an antemedial black line angled on median nervure, then incurved; a discocellular lunule; the postmedial line excurved between veins 5 and 2, then retracted to angle of cell and strongly excurved again. Hind wing with discoidal spot; the postmedial line bent outwards between veins 5 and 2, then retracted to angle of cell

and oblique to tornus; both wings with terminal series of black striæ; the cilia fuscous at base, whitish at tips.

Hab. Queensland, Dawson district (*Barnard*). *Exp.* 20 mm. Type in Coll. Rothschild.

(133)†PYRAUSTA ACHÆUSALIS Wlk. xix. 1007. Australia.

(134) PYRAUSTA PALUSTRALIS Hübn. Pyr. ff. 129, 130.
Noctua carneola Esper, pl. 69. f. 8. S.E. Europe.

(135)†PYRAUSTA MEMNIALIS Wlk. xix. 1010. Japan; China.

(136)†PYRAUSTA MACHŒRALIS Wlk. xix. 1013. Formosa; India; Ceylon; Burma; Java; Australia.
†*Scopula damastesalis* Wlk. xix. 1013; Hmpsn. Ill. Het. ix. pl. 173. ff. 1, 8.
Botys egenalis Led. Wien. Ent. Mon. 1863, p. 372, pl. 10. f. 7.
† „ *suavalis* Wlk. xxxiv. 1448.
†*Asopia rufipicta* Butl. P. Z. S. 1880, p. 682.
†*Ebulea fimbriata* Moore, Lep. Ceyl. iii. p. 346.
Paliga rubicundalis, Warr. A. M. N. H. (6) xvii. p. 96.
† „ *fuscicostalis* Swinh. A. M. N. H. (6) xiv. p. 146.

(137)†PYRAUSTA CELATALIS Wlk. xviii. 657. Formosa; Ceylon; Burma; Malayan subregion.
Botys rhœcusalis Wlk. xix. 1000.
„ *subcrocealis* Snell. Tijd. v. Ent. 1880, p. 208.

(138) PYRAUSTA FERRIFUSALIS Hmpsn. Ill. Het. ix. p. 164, pl. 172. f. 13. Ceylon; Burma.

(139) PYRAUSTA EXTINCTALIS Christ. Bull. Mosc. lvi. (1) p. 20. Siberia; Burma.

(139 *a*) PYRAUSTA HYALODISCALIS Warr. A. M. N. H. (6) xvi. p. 471. Assam.

(140)†PYRAUSTA LITHOSIALIS, n. sp.

♀. Palpi orange, black at tips; frons and antennæ black, vertex of head orange; thorax grey, tegulæ with black band, shoulders and metathorax behind orange; legs orange and fuscous; abdomen orange, with fuscous ventral spots. Fore wing grey; an orange fascia on costal area; the basal half of costa black; the inner margin and termen orange. Hind wing orange; a large apical patch, a wedge-shaped terminal patch on vein 2, and the inner area blackish.

Hab. Natal, Northdene. *Exp.* 24 mm.

(141) PYRAUSTA RUBRITINCTALIS Warr. A. M. N. H. (6) xvi. p. 471. Assam.
Syllythria metallica Warr. A. M. N. H. (6) xviii. p. 107.

(142) PYRAUSTA CRUORALIS Warr. A. M. N. H. (6) xvi. p. 471. Assam.

(143) PYRAUSTA CARDINALIS Guen. Delt. & Pyr. p. 188, pl. 7. f. 6. W. Indies; Brazil.

Synchromia coccinealis Wlk. xxxiv. 1292.
Botys carnifex Feld. Reis. Nov. pl. 134. f. 36.

(144)*PYRAUSTA MUSTELALIS Wlk. xix. 924. Borneo.

(145) PYRAUSTA PHŒNICEALIS Hübn. Verz. p. 348. Nearctic, Neotropical, Ethiopian, Oriental, & Australian regions.

†*Rhodaria flegialis* Wlk. xvii. 316.
† „ *panopealis* Wlk. xvii. 318.
†*Botys cœcilialis* Wlk. xviii. 581.
Rhodaria probalis Wlk. xix. 923.
† „ *ocellusalis* Wlk. xix. 923.
† „ *noraxalis* Wlk. xix. 926.
† „ *catenalis* Wlk. xxxiv. 1282.
† „ *juncturalis* Wlk. xxxiv. 1283.
„ *concatenalis* Wlk. xxxiv. 1284.
Myriostephes heliamma Meyr. Trans. Ent. Soc. 1885, p. 448.

(146) PYRAUSTA INSIGNITALIS Guen. Delt. & Pyr. p. 173. U.S.A.; W. Indies; S. Amer.

†*Botys eratalis* Wlk. xviii. 578.
† „ *onythesalis* Wlk. xviii. 734.
†*Asopia largalis* Wlk. xix. 938.
†*Scopula ordinatalis* Wlk. xxxiv. 1465.

(147) PYRAUSTA TINCTALIS Led. Wien. Ent. Mon. 1863, p. 371, pl. 9. f. 5. Brazil.

(148)†PYRAUSTA ACRIONALIS Wlk. xix. 925. U.S.A.

†*Rhodaria acuphisalis* Wlk. xix. 926.
Botys proceralis Led. Wien. Ent. Mon. 1863, p. 367.
„ *haruspica* Grote & Rob. Tr. Am. Ent. Soc. i. p. 19, pl. 2. f. 14.
† *Pyrausta sumptuosalis* Wlk. xxxiv. 1281.
†*Botys rufifimbrialis* Grote, Can. Ent. xiii. p. 34.

(149)†PYRAUSTA PYROCAUSTA, n. sp.

Head, thorax, and abdomen fulvous brown; palpi white at base. Fore wing yellow, suffused with fulvous brown; an antemedial sinuous black line bent outwards below the cell; a point in cell and pair of discoidal points; the postmedial line excurved and minutely dentate between veins 5 and 2, below which it is angled inwards; a subterminal oblique diffused line and terminal series of points. Hind wing orange-yellow, with postmedial black line oblique from costa to vein 2, where it is angled; a terminal fuscous band narrowing from costa to a point near tornus; a terminal series of black points.

Ab. 1. Fore wing with the oblique subterminal band much more prominent, defined on inner side by clear yellow and on outer side

diffused nearly to termen; hind wing with the costal and inner areas fuscous.

Hab. Brazil: São Paulo, Paraña (*Jones*). *Exp.* 20 mm.

(150) PYRAUSTA RUBRICALIS Hübn. Pyr. f. 106. U.S.A.
Botys similalis Led. Wien. Ent. Mon. vii. p. 367.
†*Rhodaria nescalis* Wlk. xvii. p. 315.
Botis californicalis Pack. Ann. N. Y. Lyc. 1873, p. 260.

(151)†PYRAUSTA ILITHUCIALIS Wlk. xvii. 324. S. America.

(152)*PYRAUSTA PROCHYTALIS Druce, Biol. Centr.-Am., Het. ii. p. 208, pl. 60. f. 24. Guatemala.

(153) PYRAUSTA CHILIALIS Feld. Reis. Nov. pl. 134. f. 30. Chili.

(154)†PYRAUSTA PURPURARIA Butl. Trans. Ent. Soc. 1883, p. 52. Chili.

(155) PYRAUSTA BOREALIS Pack. Labr. xi. p. 50. Canada; U.S.A.
†*Botys matronalis* Grote, Bull. Buff. Soc. N. Sci. ii. p. 231.

(156)†PYRAUSTA SUBMARGINALIS Wlk. xxxiv. 1288.
Hab. Unknown.

(157) PYRAUSTA SUBSEQUALIS Guen. Delt. & Pyr. p. 177, pl. 8. f. 3.
Herbula insequalis Guen. Delt. & Pyr. p. 447. U.S.A.
†*Isopteryx madetisalis* Wlk. xix. 946.
†*Herbula repletalis* Wlk. xxxiv. 1285.
† „ *efficitalis* Wlk. xxxiv. 1287.

(158) PYRAUSTA OFFUMALIS Hulst, Tr. Am. Ent. Soc. xiii. p. 150. U.S.A.

(159)†PYRAUSTA COMMIXTALIS Wlk. xxxiv. 1459.
†*Crambus indotatellus* Wlk. xxxv. 1752. U.S.A.; Finland.
Botys septentrionalis Tengstr. Cat. p. 358.
Eurycreon cereralis Zell. Verh. z.-b. Ver. Wien, 1872, p. 517.

(160) PYRAUSTA MANUALIS Hübn. Pyr. ff. 195–197. S. Europe; W. Asia; Siberia.
„ „ var. *furvalis* Ev. Bull. Mosc. 1842, p. 561.

(161) PYRAUSTA CESPITALIS Schiff. Wien. Verz. p. 123. Palæarctic region; N. India; Burma.
Tortrix zonana Schäff. Icones, pl. 262. ff. 4, 5.
Tinea vestianella Clerck, Icones, pl. ii. f. 11.
Pyralis sordidalis Hübn. Pyr. pl. 7. f. 40.
Pyrausta intermedialis Dup. Lép. Fr. p. 350, pl. 234. ff. 1, 2.
Botys despicata Scop. Ent. Carn. no. 579.
†*Herbula picarialis* Wlk. xxxiv. 1287.
Botys tendinosalis Brem. Lep. Ost-Sib. p. 99, pl. 8. f. 10.

(162) PYRAUSTA GENEROSA Grote & Rob. Tr. Am. Ent. Soc. i. p. 20, pl. 2. f. 10. U.S.A.

(163)†Pyrausta flavofascialis Grote, Bull. U.S. Geol. Surv. vi. p. 577. U.S.A.

(164) Pyrausta idessa Druce, Biol. Centr.-Am., Het. ii. p. 206, pl. 60. f. 20. Guatemala.

(165)†Pyrausta rubrivena Warr. A. M. N. H. (6) ix. p. 176 (1892.). Madagascar.

(166) Pyrausta sanguinalis Linn. Syst. Nat. xii. no. 339. Europe; W. Asia; Siberia; N.W. Himalayas.
Rhodaria hæmatalis Hübn. Pyr. f. 178 (var.).
„ *auroralis* Zell. Isis, 1847, p. 645 (var.).
„ *virginalis* Dup. Lép. Fr. viii. p. 216, pl. 224. f. 3.
Ebulea simplicealis Brem. Lep. Ost-Sib. p. 71, pl. 6. f. 13.

(167) Pyrausta tithonialis Zell. Verh. z.-b. Ver. Wien, 1872, p. 504, pl. 3. f. 15. Siberia.
Botys dotatalis Christ. Bull. Mosc. lvi. (1) p. 12.

(168) Pyrausta pellicalis Stgr. Hor. Ent. Ross. vii. p. 189. Spain.

(169) Pyrausta castalis Tr. Schm. Eur. vii. p. 164. S. Europe.

(170) Pyrausta laticlavia Grote & Rob. Tr. Am. Ent. Soc. i. p. 17, pl. 2. f. 12. U.S.A.
Botis cinerosa Grote & Rob. Tr. Am. Ent. Soc. i. p. 17, pl. 2. f. 13 (var.).

(171) Pyrausta tyralis Guen. Delt. & Pyr. p. 169. U.S.A.
† „ *erosnealis* Wlk. xvii. 311.
Botis diffissa Grote & Rob. Tr. Am. Ent. Soc. i. p. 19.
„ *bellulalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 149.

(172)*Pyrausta salvia Druce, Biol. Centr.-Am., Het. ii. p. 207, pl. 60. f. 22. Mexico.

(173)†Pyrausta signatalis Wlk. xxiv. 1282. U.S.A.
Botis virulenta Grote & Rob. Tr. Am. Ent. Soc. i. p. 17.

(174) Pyrausta togalis Led. Wien. Ent. Mon. 1863, p. 371, pl. 8. f. 18. Cuba; Ecuador.

(175)†Pyrausta agathalis Wlk. xvii. 318. Venezuela.

(176)†Pyrausta volupialis Grote, Bull. U.S. Geol. Surv. iii. p. 799. U.S.A.

(177)†Pyrausta angustalis Grote, Bull. U.S. Geol. Surv. vi. p. 273. U.S.A.

(178)*Pyrausta rosa Druce, Biol. Centr.-Am., Het. ii. p. 206, pl. 60. f. 19. Mexico.

(179)†Pyrausta subnicalis Warr. A. M. N. H. (6) ix. p. 177 (1892). U.S.A.

(180)†Pyrausta atropurpuralis Grote, Can. Ent. x. U.S.A.

(181)†PYRAUSTA LETHALIS Grote, Can. Ent. xiii. p. 33. U.S.A.

(182)†PYRAUSTA NICALIS Grote, Bull. U.S. Geol. Surv. iv. p. 671. U.S.A.
Botis uxorculalis Hulst, Tr. Am. Ent. Soc. xiii. p. 153.

(183)†PYRAUSTA COCCINEA Warr. A. M. N. H. (6) ix. p. 176 (1892). U.S.A.

(184) PYRAUSTA PORPHYRALIS Schiff. S. U. p. 317. S. Europe.
Pyralis coccinalis Hübn. Pyr. f. 37.
Pyrausta chionealis Guen. Delt. & Pyr. p. 164, pl. 3. f. 4.

(185)†PYRAUSTA ORPHISALIS Wlk. xvii. 310. U.S.A.

(186)*PYRAUSTA RANALIS Feld. Reis. Nov. pl. 136. f. 6. Bogota.

(187) PYRAUSTA FALCATALIS Guen. Delt. & Pyr. p. 167. S. Europe.
„ *phœnicealis* F. R. p. 278, pl. 93. f. 2 (preocc.).

(188)*PYRAUSTA RHEALIS Druce, Biol. Centr.-Am., Het. ii. p. 207, pl. 60. f. 23. Guatemala.

(189) PYRAUSTA PURPURALIS Linn. Syst. Nat. ed. xii. i. p. 883.
Botys inflammata Scop. Ent. Carn. 564. Europe.
Pyralis punicealis Hübn. Pyr. f. 34.
„ *ostrinalis* Hübn. Pyr. f. 113.
„ *mœstalis* Dup. Lép. Fr. viii. p. 226, pl. 224.
„ *chermesinalis* Guen. Delt. & Pyr. p. 167 (var.).

(190) PYRAUSTA AURATA Scop. Ent. Carn. no. 565. Europe; Syria; Persia; Afghanistan.
Pyralis punicealis Schiff. W. V. p. 317.
„ *porphyralis* Hübn. Pyr. f. 36.

(191)†PYRAUSTA TRIZONALIS, n. sp.

♂. Head, thorax, and abdomen black, mixed with ochreous scales; pectus and ventral surface of abdomen ochreous. Fore wing blackish tinged with red; a diffused orange antemedial band; a spot in end of cell; a broad diffused orange postmedial band crossed below costa by the dark postmedial line, which is excurved between veins 6 and 2; an ill-defined subterminal orange band and spot above tornus. Hind wing black, with orange subbasal patch below the cell; orange medial and subterminal bands not reaching costa, the former angled at middle, the latter expanding into a patch below costa and obsolescent towards tornus. Underside of fore wing black, with the orange markings much more sharply defined.

♀. Fore wing suffused with rufous, the orange and black markings all blurred and ill-defined.

Hab. Mexico: Cordoba, Orizaba (*Schaus*). *Exp.* 16 mm. Type ♂ in Coll. Schaus.

(192)†Pyrausta phæophœnica, n. sp.

♂. Head, thorax, and abdomen black, mixed with ochreous and dark purple-red scales; abdomen suffused with red on dorsum and with pale segmental lines. Fore wing dark purple-red, irrorated with yellow and greyish scales; indistinct waved subbasal and antemedial yellow lines; a yellow spot in end of cell; a sinuous postmedial line strongly excurved between veins 5 and 2; a subterminal line represented by marks below apex and above tornus. Hind wing black-brown, with yellow spot below middle of cell; a postmedial band between veins 5 and 2; subterminal spots below veins 6 and 2, and a spot on inner margin above tornus. Underside with much more developed greyish-yellow markings.

Hab. Brazil, Castro Parana (*Jones*). *Exp.* 14 mm.

(193)*Pyrausta latinigralis, n. sp.

♀. Head and thorax black; palpi orange below; vertex of head with some orange scales; legs orange, fore legs with black on femora and tibiæ; abdomen orange, with slight lateral segmental black marks and some black on terminal segment. Fore wing black, with orange antemedial band expanding at middle; a spot in end of cell; the postmedial line excurved between veins 5 and 2, then retracted to angle of cell, defined by an orange band from costa to vein 5, a line from vein 5 to 3, and an orange patch below cell; cilia orange at apex and tornus. Hind wing orange; an oblique antemedial black line; the postmedial line bent outwards between veins 5 and 2, then oblique to tornus; the terminal area black with sinuous inner edge, wide at costa and narrowing to tornus.

Hab. Niger, Warri (*Roth*). *Exp.* 20 mm. Type in Coll. Rothschild.

(194) Pyrausta niepoldalis Led. Wien. Ent. Mon. 1863, p. 46, pl. 8. f. 6. Silesia.

(195) Pyrausta trimaculalis Stgr. S. E. Z. 1867, p. 109. Greece; Armenia.

(195*a*)†Pyrausta tetraplagalis, n. sp. (1898, Plate L. fig. 25.)

♂. Head orange, antennæ and tufts above eyes blackish; thorax orange, with two black stripes; abdomen orange, with dorsal series of blackish marks. Fore wing black, with orange subbasal band; a medial triangular spot on costa; a round patch on inner area just beyond middle; an elliptical subterminal patch extending from costa to vein 2. Hind wing black, the basal area orange; a broad postmedial band narrowing somewhat on inner area.

Hab. Mashonaland, Salisbury (*Marshall*). *Exp.* 16 mm.

(196) Pyrausta sikkima Moore, Lep. Atk. p. 207. Himalayas; Andamans.

† „ *maculata* Butl. Ill. Het. vii. p. 93, pl. 134. f. 16.

(197)*Pyrausta aurantifascialis Hmpsn. Moths Ind. iv. p. 429. Burma.

(198)†Pyrausta chrysitis Butl. Trans. Ent. Soc. 1881, p. 584. Japan.

(199)†Pyrausta unipunctata Butl. Trans. Ent. Soc. 1881, p. 584. Japan.

(200)†Pyrausta limbata Butl. Ill. Het. iii. p. 73, pl. 58. f. 13. Japan.

(201) Pyrausta silhetalis Guen. Delt. & Pyr. p. 166. C. Asia; Himalayas; Assam.
Botys pangialis Feld. Reis. Nov. pl. 134. f. 25.
Pyrausta cuprealis Moore, A. M. N. H. (5) i. p. 235 (1878); and 2nd Yarkand Mission, pl. i. f. 26.

(202) Pyrausta obfuscata Scop. Ent. Carn. p. 232. S. Europe.
„ *pygmœalis* Dup. Lép. Fr. viii. p. 225, pl. 224. f. 7.
„ *fucatalis* Tr. Schmett. Eur. x. 3, p. 36.
„ *atrosanguinalis* Ev. F. & U. p. 471.

(203) Pyrausta acontialis Stgr. S. E. Z. 1859, p. 221. S. Europe; Armenia.
„ „ var. *senicalis* Stgr. S. E. Z. 1859, p. 221.

(204)†Pyrausta niveicilialis Grote, Bull. Buff. Soc. ii. p. 232. U.S.A.

(205) Pyrausta peregrinalis Ev. Bull. Mosc. 1852, p. 164.
Botys limitalis Christ. Bull. Mosc. lvi. (1) p. 14. Siberia.

(206)†Pyrausta marginalis Wlk. xxxiv. 1459. U.S.A.
†*Botis stenopteralis* Grote, Can. Ent. x. p. 26.

(207) Pyrausta fascialis Hübn. Pyr. f. 31. S. Europe; W. Asia.

(208) Pyrausta nigrata Scop. Ent. Carn. 580. Europe.
Pyralis anguinalis Hübn. Pyr. f. 32.
„ *fascialis* Schr. Faun. Boic. p. 65.

Type. (209) Pyrausta cingulata Linn. Syst. Nat. x. p. 259. Europe.
Botys æthiopata Scop. Ent. Carn. 581.
Ennychia fascialis Dup. Lép. Fr. viii. p. 247, pl. 226. f. 3.

(210) Pyrausta albofascialis Tr. Schmett. Eur. vii. p. 196. S. Europe.
Ennychia minutalis Speyer, S. E. Z. 1868, p. 111.

(211)†Pyrausta arabica Butl. P. Z. S. 1884, p. 500. Arabia.

(212)†Pyrausta commortalis Grote, Can. Ent. xiii. p. 233. U.S.A.

(213)†Pyrausta versicolor Warr. A. M. N. H. (6) ix. p. 175 (1892). U.S.A.

(214) Pyrausta nigralis Fabr. Ent. Syst. p. 421. Europe.

(215) PYRAUSTA NYCTEMERALIS Hübn. Pyr. f. 148. Europe.
Hercyna intricalis Ev. Bull. Mosc. 1854, ii. p. 193.

(216) PYRAUSTA UNIMACULA Grote & Rob. Tr. Am. Ent. Soc. i. p. 14, pl. 2. f. 8. U.S.A.

(217)†PYRAUSTA ASTRIFERA Butl. Ill. Het. iii. p. 73, pl. 58. f. 14. Japan

(218)†PYRAUSTA ASSIMILIS Butl. Ill. Het. iii. p. 73, pl. 58. f. 12. Japan.

(219)†PYRAUSTA GLOMERALIS Wlk. xvii. 330. U.S.A.

(220) PYRAUSTA OCTOMACULATA Linn. Mant. 540. Europe;
Phalæna atralis Fabr. Ent. Syst. 422. W. Asia.
Pyralis guttulalis Schiff. Wien. Verz. p. 124.
Noctua trigutta Esp. iv. p. 84, pl. 163. f. 4.

Auctorum.

Botys perpendiculalis Dup. Lép. Fr. viii. p. 324, pl. 232. f. 5. S. France.
„ *appositalis* Led. Wien. Ent. Mon. 1858, p. 148, pl. 7. Syria.
„ *crudalis* Led. Wien. Ent. Mon. 1863, p. 372, pl. 10. f. 5. Syria.
„ *saxatilis* Staud., Meyr. Trans. Ent. Soc. 1890, p. 450. Europe.
„ *fimbriatalis* Dup. Lép. Fr. viii. p. 352, pl. 234. f. 3. S.E. Europe; Armenia.
„ *designatalis* Chr., Rom. Mém. iii. p. 28, pl. ii. f. 3. W. Asia.
„ *amasialis* Staud. W. Asia.
=*trinalis* var. *pontica* Rom. Mém. ii. p. 146, pl. 7. f. 12.
„ *vastalis* Chr., Rom. Mém. iii. p. 33, pl. ii. f. 5. W. Asia.
„ *concoloralis* Led. Wien. Ent. Mon. 1857, p. 100. Syria.
Eurycreon scalaralis Chr. Hor. Ent. Ross. xii. p. 275, pl. 7. f. 46. W. Asia.
Botys consortalis H.-S. vi. p. 142, ff. 130, 131. Spain.
Pyralis scutalis Hübn. Pyr. f. 156. S. Europe.
Botys vittalis Lah. Nouv. Mém. Soc. Helv. Sci. Nat. p. 33. Switzerland.
„ *deceptalis* Lah. Nouv. Mém. Soc. Helv. Sci. Nat. p. 37. Switzerland.
„ *auralis* Peyerimh. Pet. Nouv. 1872, p. 252. ? Alsace.
„ *pauperalis* Staud. Hor. Ent. Ross. xv. p. 173. Armenia.
„ *retowskyi* Möschl. S. E. Z. xlix. p. 128. Crimea.
„ *gutturalis* Staud. Hor. Ent. Ross. xv. p. 175. Magnesia.
„ *dorcalis* Rom. Mém. v. p. 230, pl. xi. f. 7. Teneriffe.
Pyrausta dorsipunctalis Rebel, Ann. Hofmus. Wien, vii. p. 245. Canaries.

Botys maderensis Beth. Baker, Trans. Ent. Soc. 1894, p. 584. Madeira.
„ *atlanticum* Beth. Baker, Trans. Ent. Soc. 1894, p. 584. Madeira.
„ *murcialis* Rag. Bull. Soc. Ent. Fr. 1895, p. xxiii. Spain.
Pyrausta cuprinalis Rag. Bull. Soc. Ent. Fr. 1895, p. xcvii. Syria.
Botys sedakovialis Ev. Bull. Mosc. 1852, p. 165. E. Siberia.
Eurycreon eversmanni Stgr. Deutsch. Ent. Zeit., Lep. v. pl. iii. f. 21, & vi. p. 80. Central Asia.
Botys tesserulalis Christ. Hor. Ent. Ross. x. p. 44. N. Persia.
„ *fibulalis* Christ. Bull. Mosc. lvi. (1) p. 9. Amur.
„ *solemnalis* Christ. Bull. Mosc. lvi. (1) p. 10. Amur.
„ *pullatalis* Christ. Bull. Mosc. lvi. (1) p. 12. Amur.
„ *clausalis* Christ. Bull. Mosc. lvi. (1) p. 18. Amur.
„ *aurithoracalis* Chr., Rom. Mém. ii. p. 145, pl. vii. f. 11. Achal Tekké.
Hercyna nanalis Christ. Hor. Ent. Ross. xxii. p. 310. C. Asia.
Botys græseri Staud. Deutsch. Ent. Zeit., Lep. v. p. 384, pl. iii. f. 24. Siberia.
Herpetogramma expictalis Christ. Bull. Mosc. lvi. (1) p. 36. Amur.
Botys ochreocapitalis Rag. Ann. Soc. Ent. Fr. 1894, p. 165. Amur.
„ *caliginosalis* Rag. Ann. Soc. Ent. Fr. 1894, p. 166. Amur.
Samea geographicalis Guen. Delt. & Pyr. p. 197. E. Indies.
„ *continentalis* Guen. Delt. & Pyr. p. 197. E. Indies.
Botys lineolalis Motsch. Bull. Soc. Nat. Mosc. xxxix. i. p. 198. Japan.
Pyrausta thibetalis Oberth. Et. Ent. xi. p. 35, pl. ii. f. 6. Tibet.
„ *bieti* Oberth. Et. Ent. xi. p. 35, pl. ii. f. 10. Tibet.
Ennychia mœnialis Oberth. Et. Ent. xix. p. 37, pl. vi. f. 55. Tibet.
Botys velatalis Snell. Midd.-Sum. iv. (1) 8, p. 63. Sumatra.
„ *omicronalis* Snell. Midd.-Sum. iv. (1) 8, p. 63. Sumatra.
„ *amboinalis* Pag. J.B. Nass. Ver. xxvii. p. 268, pl. vi. f. 2. Amboina.
„ *quinquemaculalis* Pag. J.B. Nass. Ver. xxxviii. p. 54. Nias.
„ *murinalis* Pag. J.B. Nass. Ver. xxxviii. p. 55. Nias.
„ *flavoviolalis* Pag. J.B. Nass. Ver. xxxviii. p. 56. Nias.
„ *catasemalis* Rober, Tijd. Ent. xxxiv. p. 333, & xxxv. pl. 6. f. 8. Ké I.
„ *ictericalis* Snell. Tijd. v. Ent. xxxviii. p. 119. Java.
„ *fuscocilialis* Snell. Tijd. v. Ent. xxxviii. p. 122. Java.
„ *fuscinervalis* Snell. Tijd. v. Ent. xxxviii. p. 123. Java.
„ *epitrota* Meyr. Trans. Ent. Soc. 1887, p. 231. Australia.
Pyrausta straminea Lucas, P. Linn. Soc. N. S. W. (2) vii. p. 263. Queensland.
„ *violacea* Lucas, P. Linn. Soc. N. S. W. (2) vii. p. 263. Queensland.
„ *nerialis* Boisd. Faun. Mad. p. 119. Mauritius.

Pyrausta minutalis Mab. Ann. Soc. Ent. Fr. (5) ix. p. 339. Madagascar.
„ *monotretalis* Mab. Ann. Soc. Ent. Fr. (5) ix. p. 339. Madagascar.
„ *acosmialis* Mab. Bull. Soc. Philom. (7) iii. p. 144. Madagascar.
Botys bifenestralis Mab. C.R. Ent. Belge, xxiii. p. xxv. Madagascar.
„ *stenopalis* Mab. C.R. Ent. Belge, xxiii. p. xxv. Madagascar.
„ *vinilialis* Mab. C.R. Ent. Belge, xxiii. p. xxv. Madagascar.
„ *chrysotalis* Mab. C.R. Ent. Belge, xxiii. p. cviii. Madagascar.
„ *prasinalis* Saalm. Ber. Senck. Ges. 1879–80, p. 301. Madagascar.
„ *distinctalis* Saalm. Ber. Senck. Ges. 1879–80, p. 302. Madagascar.
„ *ferruginalis* Saalm. Ber. Senck. Ges. 1879–80, p. 302. Madagascar.
„ *carnosalis* Saalm. Ber. Senck. Ges. 1879-80, p. 302. Madagascar.
„ *gravitalis* Saalm. Ber. Senck. Ges. 1879–80, p. 303. Madagascar.
„ *ochracealis* Saalm. Ber. Senck. Ges. 1879–80, p. 303. Madagascar.
„ *posticalis* Saalm. Ber. Senck. Ges. 1879–80, p. 304. Madagascar.
„ *holoxanthalis* Mab. C.R. Ent. Belge, xxv. p. lxii. Madagascar.
„ *adsocialis* Zell. Lep. Caffr. p. 41. S. Africa.
Rhodaria cinnamomealis Wlgrn. W. E. M. 1860, p. 175. S. Africa.
Botys lacunalis Zell. Lep. Caffr. p. 42. S. Africa.
„ *approximalis* Guen. Delt. & Pyr. p. 360. W. Africa.
„ *interficalis* Wlk. Tr. N. H. Soc. Glasg. i. p. 370. Congo.
„ *aburalis* Plötz, S. E. Z. xli. p. 304. W. Africa.
„ *mungalis* Plötz, S. E. Z. xli. p. 304. W. Africa.
„ *butleri* Dewitz, Verh. L.-C. Ac. xlii. p. 87, pl. iii. f. 13. Guinea.
„ *sordidalis* Dewitz, Verh. L.-C. Ac. xlii. p. 88, pl. iii. f. 11. Lagos.
„ *fumarialis* Dewitz, Verh. L.-C. Ac. xlii. p. 88, pl. iii. f. 19. Guinea.
„ *trigonalis* Mab. Ann. Soc. Ent. Fr. (6) x. p. 51. W. Africa.
Prorasea lepidalis Hulst, Tr. Am. Ent. Soc. xiii. p. 146. U.S.A.
Eurycreon aureolalis Hulst, Tr. Am. Ent. Soc. xiii. p. 156. U.S.A.
Botys venalalis Hulst, Tr. Am. Ent. Soc. xiii. p. 151. U.S.A.
„ *labeculalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 152. U.S.A.
„ *succandidalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 153. U.S.A.

Botys thallophilalis Hulst, Tr. Am. Ent. Soc. xiii. p. 154. U.S.A.
„ *oblectalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 154. U.S.A.
„ *abdominalis* Zell. Verh. z.-b. Wien, xxii. p. 515. U.S.A.
„ *penitalis* Grote, Can. Ent. viii. p. 98. U.S.A.
„ *toralis* Grote, Bull. U. S. Geol. Surv. vi. pp. 167, 178. U.S.A.
„ *radiosalis* Möschl. S. E. Z. xliv. p. 123. Labrador.
„ *inornatalis* Fern. Can. Ent. xvii. p. 57. Florida.
Orobena castanealis Hulst, Tr. Am. Ent. Soc. xiii. p. 157. U.S.A.
Botys roseipennalis Hulst, Tr. Am. Ent. Soc. xiii. p. 148. U.S.A.
„ *nexalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 150. U.S.A.
„ *gracilalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 151. U.S.A.
„ *hædulalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 152. U.S.A.
„ *octosignalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 153. U.S.A.
„ *scurralis* Hulst, Tr. Am. Ent. Soc. xiii. p. 155. U.S.A.
„ *nelumbialis* Smith, Ent. Am. vi. p. 88. U.S.A.
„ *magdalena* Fern. Can. Ent. xxiv. p. 122. Florida.
„ *nigralis* Fern. Can. Ent. xxiv. p. 178. Florida.
„ *polygamalis* Snell. Tijd. v. Ent. 1875, p. 195, pl. ii. ff. 5, 6. Jamaica.
Eurycreon collucidalis Möschl. Abh. Senck. Ges. xvi. p. 290. Porto Rico.
Botys insularis Grote & Rob. Trans. Am. Ent. Soc. i. p. 24, pl. 2. f. 24. Cuba.
„ *acutangulalis* Snell. Tijd. v. Ent. xviii. p. 200, pl. xi. f. 11. W. Indies.
„ *claudialis* Snell. Tijd. v. Ent. xviii. p. 204, pl. xi. f. 14. W. Indies.
„ *samealis* Snell. Tijd. v. Ent. xviii. p. 205, pl. xi. f. 15. W. Indies.
„ *variegalis* Snell. Tijd. v. Ent. xviii. p. 207, pl. xii. ff. 1, 2. W. Indies.
„ *aulicalis* Möschl. Abh. Senck. Ges. xiv. p. 75. Jamaica.
„ *villicalis* Möschl. Abh. Senck. Ges. xiv. p. 76. Jamaica.
„ *matronulalis* Möschl. Abh. Senck. Ges. xiv. p. 76. Jamaica.
„ *meropialis* Möschl. Abh. Senck. Ges. xiv. p. 77. Jamaica.
„ *janiralis* Möschl. Abh. Senck. Ges. xiv. p. 78. Jamaica.
„ *occidentalis* Snell. Tijd. v. Ent. xxx. p. 57, pl. 5. ff. 2, 2*a*. Curaçoa.
„ *citrinalis*, Möschl. Abh. Senck. Ges. xvi. p. 282. P. Rico.
„ *oculatalis*, Möschl. Abh. Senck. Ges. xvi. p. 282. P. Rico.
„ *pertentalis*, Möschl. Abh. Senck. Ges. xvi. p. 284, f. 7. P. Rico.
„ *albifrontalis* Möschl. Abh. Senck. Ges. xvi. p. 284. P. Rico
„ *principaloides* Möschl. Abh. Senck. Ges. xvi. p. 285. P. Rico.

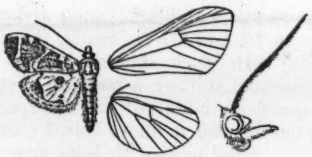
Botys placendalis Möschl. Abh. Senck. Ges. xvi. p. 285. P. Rico.
„ *visendalis* Möschl. Abh. Senck. Ges. xvi. p. 285. P. Rico.
„ *intricatalis* Möschl. Abh. Senck. Ges. xvi. p. 286. P. Rico.
„ *evincalis* Möschl. Abh. Senck. Ges. xvi. p. 287. P. Rico.
„ *concinnalis* Möschl. Abh. Senck. Ges. xvi. p. 287. P. Rico.
„ *fortificalis* Möschl. Abh. Senck. Ges. xvi. p. 288. P. Rico.
„ *secernalis* Möschl. Abh. Senck. Ges. xvi. p. 288. P. Rico.
„ *flammeolalis* Möschl. Abh. Senck. Ges. xvi. p. 289. P. Rico.
„ *pantoppidani* Hedemann, Stettin. Ent. Zeit. lv. p. 284. St. Croix.
„ *flavaginalis* Hedemann, Stettin. Ent. Zeit. lv. p. 285. St. Croix.
Syllythria conradti Druce, Biol. Centr.-Am., Het. ii. p. 207, pl. 60. f. 21. Guatemala.
Botys lautalis Led. Wien. Ent. Mon. 1863, p. 370, pl. 8. f. 13. Colombia.
„ *eoidalis* Feld. Reis. Nov. pl. 135. f. 14. Bogota.
„ *vicarialis* Snell. Tijd. v. Ent. xviii. p. 194, pl. xi. f. 4. Bogota.
„ *communalis* Snell. Tijd. v. Ent. xviii. p. 196, pl. xi. f. 7. Bogota.
Eurycreon ornamentalis Möschl. Verh. z.-b. Wien, xxxi. p. 418, pl. xviii. f. 28. Surinam.
Botys glutalis Möschl. Verh. z.-b. Wien, xxxi. p. 420, pl. xviii. f. 31. Surinam.
„ *patronalis* Möschl. Verh. z.-b. Wien, xxxi. p. 421, pl. xviii. f. 31. Surinam.
„ *luciferalis* Möschl. Verh. z.-b. Wien, xxxi. p. 422, pl. xviii. f. 32. Surinam.
„ *delavalis* Möschl. Verh. z.-b. Wien, xxxi. p. 422, pl. xviii. f. 33. Surinam.
„ *percludalis* Möschl. Verh. z.-b. Wien, xxxi. p. 422. Surinam.
„ *dolosalis* Möschl. Verh. z.-b. Wien, xxxi. p. 423. Surinam.
„ *metricalis* Möschl. Verh. z.-b. Wien, xxxi. p. 423. Surinam.
„ *flexalis* Möschl. Verh. z.-b. Wien, xxxi. p. 424. Surinam.
„ *terricolalis* Möschl. Verh. z.-b. Wien, xxxi. p. 424. Surinam.
„ *tenuialis* Möschl. Verh. z.-b. Wien, xxxi. p. 425, pl. xviii. f. 34. Surinam.
Phalæna surinamensis Sepp, Surinam, ii. 137, pl. 65. Surinam.
„ *stigmatalis* Sepp, Surinam, ii. 257, pl. 107. Surinam.
„ *jatrophalis* Sepp, Surinam, ii. 131, pl. 62. Surinam.
Botys suavidalis Berg, S. E. Z. xxxvii. p. 345. Brazil.
„ *perlalis* Maasen, Stübel's Reise, p. 169, f. 23. Ecuador.

Genus 150. Sceliodes.

Sceliodes Guen. Delt. & Pyr. p. 400 (1856).
Daraba Wlk. xvii. 385 (1859).
Eretria Snell. Tijd. v. Ent. 1880, p. 206.

Palpi porrect, straight, about two and a half times length of head, the 2nd joint fringed with long hair below, the 3rd naked; maxillary palpi filiform; frons with large conical prominence; antennæ ciliated. Fore wing long and narrow, the apex somewhat produced and acute; veins 3, 4, 5 separate; 7 straight and well separated from 8, 9. Hind wing with the apex produced; veins 3, 4, 5 separate; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 150.



Sceliodes cordalis, ♂. ½.

Type. (1) Sceliodes cordalis Doubl. in Dieff. N. Zeal. i. 288. Celebes; Australia; N. Zealand.
„ *mucidalis* Guen. Delt. & Pyr. p. 400.
†*Daraba extensalis* Wlk. xxxiv. 1311.
Eretria obsistalis Snell. Tijd. v. Ent. 1880, p. 206, & 1883, pl. 6. f. 12.

(2)†Sceliodes laisalis Wlk. xvii. 382. Arabia; S. Africa.
†*Daraba idmonealis* Wlk. xvii. 385.

Genus 151. Thelcteria.

Thelcteria Led. Wien. Ent. Mon. 1863, p. 350.
Eustixia Hübn. Zutr. i. 24. 164 (1824), non descr.

Palpi porrect and straight, the 2nd joint moderately scaled, the 3rd naked; maxillary palpi dilated with scales; frons with a

Fig. 151.

Thelcteria pupula, ♂. ½.

conical prominence; antennæ of male ciliated; tibiæ with the outer spurs half the length of inner. Fore wing with vein 3 from near angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9; 10 well separated. Hind wing with veins 3, 4, 5 well separated at origin; 6, 7 from upper angle, 7 anastomosing with 8.

Type. (1) THELCTERIA PUPULA Hübn. Zutr. i. 24. 164, ff. 327, 328. U.S.A.; Brazil.

(2)†THELCTERIA OCTONALIS Zell. Verh. z.-b. Ver. Wien, 1873, p. 211, pl. 3. f. 7. U.S.A.

†*Botys sexmaculalis* Grote, Can. Ent. viii. p. 98.

(3)†THELCTERIA DICHOCROSIALIS, n. sp.

♀. Orange; fore tibiæ with black band; abdomen with paired dorsal black spots on 1st and 4th segments, the terminal segment black. Fore wing with black spot at base of inner margin; an oblique black antemedial line; a postmedial straight line from costa to vein 5; a spot below middle of vein 2, a speck below it above inner margin and one beyond it above vein 1; subterminal spots above veins 4 and 7. Hind wing with large spot beyond the cell; a curved bar between vein 2 and tornus, and subterminal spots above veins 2 and 6.

Hab. Arjuno, Java (*Doherty*). *Exp.* 24 mm.

Genus 152. CORNIFRONS.

Cornifrons, Led. Wien. Ent. Mon. 1863, p. 384.

Palpi porrect, the 2nd joint moderately scaled, the 3rd prominent; maxillary palpi long and slightly dilated at extremity; frons with long corneous process with oblique vertical edge; antennæ ciliated; tibiæ with the outer spurs two-thirds length of inner. Fore wing with vein 3 from before angle of cell; 4, 5 from angle; 7 straight and well separated from 8, 9. Hind wing with vein 3 from near angle of cell; 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 152.

Cornifrons ulceratalis, ♂. ½.

Type. (1) CORNIFRONS ULCERATALIS Led. Wien. Ent. Mon. 1858, p. 147, pl. 4. f. 1. Algeria; Syria; Persia.

(2)†Cornifrons simalis Grote, Bull. U.S. Geol. Surv. iv. p. 670. U.S.A.

(3)†Cornifrons pulveralis Warr. A. M. N. H. (6) ix. p. 435. U.S.A.

Auctorum.

Prorasea indentalis Grote, A. M. N. H. (5) xi. p. 57 (1883). U.S.A.

Genus 153. Tegostoma.

Tegostoma Zell. Isis, 1847, p. 581.
Anthophilodes Guen. Delt. & Pyr. p. 181 (1854).
Emprepes Led. Wien. Ent. Mon. 1863, p. 360.
Æschremon Led. Wien. Ent. Mon. 1863, p. 362.
Cataonia Rag. Ann. Soc. Ent. Fr. 1891, p. 450.
Anthophilopsis Rag. Ann. Soc. Ent. Fr. (6) x. p. 449.
Turania Rag. Ann. Soc. Ent. Fr. (6) x. p. 449.

Palpi porrect, the 2nd joint slightly fringed with hair below, the 3rd naked; maxillary palpi filiform; frons with a large flat corneous process excised in front; antennæ of male ciliated; legs smoothly scaled. Fore wing long and narrow; male with a slight fovea on underside above the base of vein 7, which is bent downwards; vein 3 from before angle of cell; 4, 5 from angle. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 153.

Tegostoma comparalis, ♂. ½. (From Moths Ind. vol. iv.)

Type. (1) Tegostoma comparalis Hübn. Verz. p. 347. Mediterranean subregion; India.
Pyralis glaucinalis Hübn. Samml. Eur. Schmett., Pyr. f. 127.
† „ *tenebrosalis* Wlk. xxxiv. 1235.
†*Scopula fotalis* Swinh. P. Z. S. 1885, p. 875, pl. 57. f. 9.

(2) Tegostoma disparalis H.-S. vi. p. 140, ff. 134, 135. Armenia; Afghanistan.

(3) Tegostoma subditalis Zell. Lep. Caffr. p. 25. S. Africa.

(4) Tegostoma mœschleri Christ. S. E. Z. 1862, p. 220. Armenia; Egypt.

(5) Tegostoma baphialis Stgr. Hor. Ent. Ross. 1870, p. 183, pl. 2. f. 7. S.E. Europe; N.W. India.
Anthophilodes plumbiferalis Chr. Hor. Ent. Ross. xii. p. 270, pl. 7. f. 40.

(6) TEGOSTOMA MONOCERIALIS Rag. Ann. Soc. Ent. Fr. 1891, p. 450. Syria.

(7)†TEGOSTOMA FLAVIDA Moore, P. Z. S. 1881, p. 371. Punjab.

(8)†TEGOSTOMA BIPARTALIS Hmpsn. P. Z. S. 1896, p. 274. Aden.

(9) TEGOSTOMA PENTODONTALIS Ersch, Lep. Turk. p. 75, pl. 6. f. 97. Turkestan.

(10) TEGOSTOMA LEPIDA H.-S. ii. p. 387, f. 534. Armenia.

(11) TEGOSTOMA FLORILEGARIA Guen. Phal. p. 175. S. Africa.

(12) TEGOSTOMA PUDICALIS Dup. Lép. Fr. viii. p. 212, pl. 224. f. 1. S. Europe.

(13) TEGOSTOMA DINICHEALIS Wlk. xix. 986. W. Indies; Brazil.

Auctorum.

Anthophilodes erubescens Christ. Hor. Ent. Ross. xii. p. 271, pl. 7. f. 41. Turkestan.

" *concinnalis* Christ. Hor. Ent. Ross. xvii. p. 120. Turkestan.

" *turcomanica* Christ. Hor. Ent. Ross. xii. p. 271, pl. 7. f. 42. Turkestan.

" *conchylialis* Christ. Hor. Ent. Ross. ix. p. 7, pl. 1. f. 4. Sarepta.

Hypotia russulalis Christ. Hor. Ent. Ross. 1877, p. 263, pl. vii. f. 35. Turkestan.

Genus 154. NOCTUELIA.

Noctuelia Guen. Delt. & Pyr. p. 113 (1854).
Aporodes Guen. Delt. & Pyr. p. 159.
Aporocosmus Butl. Trans. Ent. Soc. 1886, p. 396.
Semniomima Warr. A. M. N. H. (6) ix. p. 172 (1892).
Mimoschinia Warr. A. M. N. H. (6) ix. p. 174.

Palpi porrect, the 2nd joint fringed with hair below, the 3rd naked; maxillary palpi filiform; frons with a rounded prominence; antennæ of male ciliated; mid tibiæ fringed with spinous

Fig. 154.

Noctuelia floralis, ♂. ¾. (From Moths Ind. vol. iv.)

hair. Fore wing long and narrow; vein 3 from before angle of cell; 4, 5 from angle; 6 from below upper angle. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing with 8.

SECT. I. Palpi with the 2nd joint fringed with long hair below.

A. (*Aporodes*). Fore wing of male with a slight fovea on underside above base of vein 7.

(1) NOCTUELIA FLORALIS Hübn. Samml. Eur. Schmett., Pyr. f. 142. Europe; Syria; Afghanistan;
Pyralis stygialis Treit. Eur. Schmett. vii. p. 176 (var.). C. Asia; N.W. India.
†*Herbula meleagrisalis* Wlk. xvii. p. 324 (subsp.).
Eudorea transversalis Moore, 2nd Yarkand Mission, p. 14.

B. (*Noctuelia*). Fore wing of male with no fovea on underside.

Type. (2) NOCTUELIA SUPERBA Frr. 441, p. 101. Armenia; Persia.
Anarta melaxantha Koll. Ins. Pers. p. 12.

(3) NOCTUELIA VESPERTALIS H.-S. vi. p. 140, ff. 121, 123. S. Europe; Armenia.

(4) NOCTUELIA ALTICOLALIS Christ. Hor. Ent. Ross. xii. p. 268, pl. vii. f. 39. Armenia.

(5) NOCTUELIA STAUDINGERI Christ. Hor. Ent. Ross. ix. p. 6, pl. i. f. 3. Persia; Turkestan.

(6)†NOCTUELIA OBSCURA Warr. A. M. N. H. (6) ix. p. 175 (1892). Armenia.

SECT. II. (*Aporocosmus*). Palpi moderately scaled below; fore wing of male with no fovea beyond the cell.

(7) NOCTUELIA FLAVICEPS Burm. Rep. Arg. v. p. 425. Argentina.
Type of *Semniomima*, Warren, A. M. N. H. (6) ix. p. 172 (1892).

(8) NOCTUELIA PUELLA Wlk. vii. p. 1647. Brazil.

(9)†NOCTUELIA POLYSTRIGALIS, n. sp. (1898, Plate L. fig. 24.)

Head, thorax, and abdomen black. Fore wing orange, with black streaks on costa, through the cell, in submedian interspace, and just above inner margin; the apical area, purplish black from two-thirds of costa to tornus. Hind wing purplish black, with the costa orange to near apex.

Hab. Peru. *Exp.* 32 mm.

(10)*NOCTUELIA LIGATALIS Druce, Biol. Centr.-Am., Het. ii. p. 189, pl. 29. f. 11. Mexico.

(11) NOCTUELIA COMASTIS Meyr. Trans. Ent. Soc. 1884, p. 33. N. Zealand.
†*Noctuelia intrudens* Warr. A. M. N. H. (6) ix. p. 175 (1892).

(12)†NOCTUELIA THALIALIS Wlk. xviii. 582. U.S.A.; Haiti.
†*Anthophila peruviana* Wlk. xxxiii. 804.
†*Pyralis gelidalis* Wlk. xxxiv. 1229.
Emprepes novalis Grote, Can. Ent. 1876, p. 156.
Thelcteria costæmaculalis Snell. Tijd. v. Ent. xxx. 1887, p. 54, pl. 4. f. 6.

(13)†Noctuelia nuchalis Grote, Bull. U.S. Geol. Surv. iv. p. 675. U.S.A.

(14)†Noctuelia fuscinervis Hmpsn. Moths Ind. iv. p. 445. N.W. Himalayas.

(15)†Noctuelia lamprodeta Meyr. Trans. Ent. Soc. 1886, p. 265. New Guinea; Australia.

†*Aporocosmus bracteatus* Butl. Trans. Ent. Soc. 1886, p. 399.

(16)†Noctuelia elautalis, Grote, Papilio, i. p. 168. U.S.A.
Emprepes magnalis Hulst, Tr. Am. Ent. Soc. xiii. p. 147.

(17) Noctuelia simplex Warr. A. M. N. H. (6) xvi. p. 474. U.S.A.

(18) Noctuelia isatidalis Dup. Lép. Fr. viii. p. 336, pl. 233. f. 3. Europe.

(19) Noctuelia desertalis Hübn. Pyr. f. 17. S. Europe.
Botys vandalusialis H.-S. vi. p. 142, f. 143.

(20)†Noctuelia undulosella Moore, A. M. N. H. (5) i. p. 236 (1878), & 2nd Yarkand Mission, p. 16, pl. i. f. 27. Kashgar.

(21)†Noctuelia similalis Grote, N. Am. Ent. i. p. 94. U.S.A.

Auctorum.

Aporodes dentifascialis Chr. Rom. Mém. iii. p. 20, pl. i. f. 9. W. Asia.

Noctuelia plebeialis Chr. Hor. Ent. Ross. xvii. p. 118, & Rom. Mém. iii. pl. i. f. 12. Armenia.

Aporodes arbutalis Snell. Tijd. v. Ent. xxiii. p. 190, pl. xi. f. 2. S. America.

„ *yaminalis* Oberth. Et. Ent. xii. p. 35, pl. vi. f. 35. Algeria.

Noctuelia mardinalis Staud. Deutsch. Ent. Zeit., Lep. v. pl. iii. f. 16, & vi. p. 71. Kurdistan.

Genus 155. Heliothela.

Heliothela Guen. Delt. & Pyr. p. 152 (1854).

Palpi porrect, the 2nd joint fringed below with hair towards extremity, the 3rd prominent; maxillary palpi dilated with scales;

Fig. 155.

Heliothela ophideresana, ♂. ¾. (From Moths Ind. vol. iv.)

frons rounded; antennæ of male somewhat thickened and minutely ciliated; legs short, the tibiæ smoothly scaled, with the spurs

moderate; wings short and broad. Fore wing with vein 3 from close to angle of cell; 4, 5 from angle; 6, 7 from upper angle. 7 anastomosing with 8.

(1)†Heliothela persumptana Wlk. xxviii. 459. Australia; Tasmania.

(2) Heliothela ophideresana Wlk. xxviii. 459. Madagascar; India; Ceylon; Australia.
Heliothela pusilla Butl. Ill. Het. vii. p. 93, pl. 134. f. 15.

(3)†Heliothela ochreipennis Butl. Trans. Ent. Soc. 1886, p. 429, pl. x. f. 9. Australia

(4)†Heliothela nigralbata, n. sp.

♂. Black-brown; fore wing with a pale mark beyond discocellulars; hind wing with a large pure white quadrate spot beyond the cell; underside with the spots on both wings pure white.
Hab. Chekiang, China. *Exp.* 14 mm.

Type. (5) Heliothela atralis Hübn. Pyr. f. 27. S. Europe; W. Asia.
Pyralis undulalis Schr. Faun. Boic. 1792.
„ *obfuscata* Scop. Ent. Carn. 582.

(6)†Heliothela atra Butl. P. Z. S. 1877, p. 404. N. Zealand.

(7)†Heliothela prægalliensis Frey, Lep. Schw. p. 253. Switzerland.

Auctorum.

Nyctarcha paracentra Meyr. Trans. Ent. Soc. 1887, p. 245. W. Australia.

Genus 156. Mimasarta.

Mimasarta Rag. Ann. Soc. Ent. Fr. 1894, p. 164.

Palpi porrect, extending about twice the length of head, clothed with long hair hiding the 3rd joint; maxillary palpi with tuft of long hair at extremity; frons rounded and hardly prominent;

Fig. 156.

Mimasarta niveifascialis, ♂. ½.

antennæ of male ciliated; legs smoothly scaled, hind tibiæ with the spurs nearly equal. Fore wing short and broad; vein 3 from near angle of cell; 5 from above angle; 7 well separated from 8, 9. Hind wing with the cell half the length of wing; vein 3 from

before angle of cell; 5 from above angle and almost obsolete; 6, 7 from upper angle, 7 anastomosing with 8 almost to apex.

Type. *Mimasarta niveifascialis Rag. Ann. Soc. Ent. Fr. 1894, p. 164, & Mon. Phyc. ii. pl. xxiv. f. 6. Marghilan, C. Asia.

Genus 157. Metaprotus, nov.

Palpi porrect and short, the 2nd joint fringed with long hair, the 3rd naked; maxillary palpi minute and filiform; proboscis minute; frons with a pointed corneous prominence; antennæ of female minutely ciliated; tibiæ moderately hairy, the spurs moderate. Fore wing with the costa slightly excised beyond middle; the apex somewhat produced and acute, and the outer margin somewhat excised below apex; veins 3, 4, 5 well separated at origin; 6 from below upper angle; 7, 8, 9, 10 from cell near upper angle. Hind wing with vein 3 from before angle of cell; 5 from above the angle; 6, 7 from upper angle, 7 anastomosing with 8.

Fig. 157.

Metaprotus asuridia, ♀. ½.

Type. (1)†Metaprotus asuridia Butl. Trans. Ent. Soc. 1886, p. 430, pl. x. f. 5 (♀). Queensland.

(2)*Metaprotus magnifica Meyr. Trans. Ent. Soc. 1887, p. 200, Australia.

Genus 158. Simæthistis.

Simæthistis Hmpsn. Moths Ind. iv. p. 446 (1896).

Palpi porrect, the 2nd joint fringed with long hair below, the 3rd prominent; maxillary palpi minute; frons with a rounded

Fig. 158.

Simæthistis tricolor, ♂. ½. (From Moths Ind. vol. iv.)

prominence; antennæ annulate. Fore wing with veins 3, 4 from angle of cell; 5 from well above angle; 6, 7, 8, 9, 10 at regular

intervals. Hind wing with veins 3, 4 from angle of cell; 5 from middle of discocellulars; 6, 7 from upper angle, 8 approximated to 7 for a short distance beyond end of cell, but not anastomosing with it.

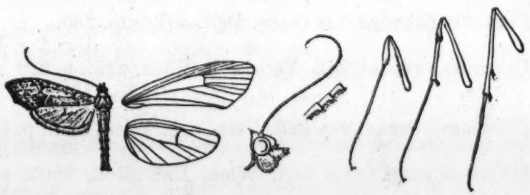
Type. †Simæthistis tricolor Butl. Ill. Het. vii. p. 95, pl. 134. f. 18. N.W. Himalayas.

Genus 159. Stenoptycha.

Stenoptycha Zell. S. E. Z. 1863, p. 154.

Palpi porrect, extending hardly the length of head, the 1st joint very broadly scaled below, the 2nd with shorter scales extending as far as the short naked 3rd joint; maxillary palpi small and dilated with scales; frons with a rounded prominence; antennæ longer than fore wing, annulate and ciliated; legs very long and slender, tibiæ with the spurs minute; abdomen long and slender, with lateral tufts. Fore wing very long and narrow, veins 3, 4, 5 from angle of cell; 6 from below upper angle; 8, 9 stalked. Hind wing somewhat ample; veins 3, 4 from angle of cell; 5 absent; cell long; 6, 7 from upper angle; 8 becoming coincident with 7.

Fig. 159.



Stenoptycha cælodactyla, ♂. ½.

Type. (1) Stenoptycha cælodactyla Zell. S. E. Z. 1863, p. 154, pl. ii. f. 12. Ecuador; Bogota; Chili.
„ *lindigi* Feld. Reise Nov. pl. 140. f. 61.
† „ *zelleri* Butl. Trans. Ent. Soc. 1883, p. 57.
Agathodes dubitalis Maasen, Stübel's Reise, p. 170, pl. ix. f. 21.

(2)†Stenoptycha pterophoralis Wlk. xxxiv. 1340. St. Domingo.

(3)*Stenoptycha erschoffiana Zell. Hor. Ent. Ross. xiii. p. 457, pl. vi. f. 159. Bogota.

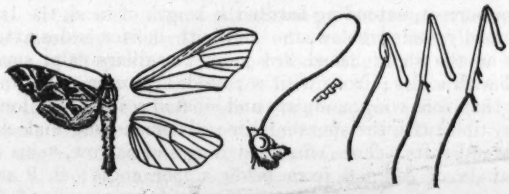
Genus 160. Lineodes.

Lineodes Guen. Delt. & Pyr. p. 234 (1854).
Scoptonoma Zell. Verh. z.-b. Wien, xxiii. p. 328 (1873).

Palpi porrect, hardly the length of head, the 1st joint very broadly fringed with scales below, the 2nd with shorter scales projecting as far as the short naked 3rd joint; maxillary palpi filiform;

frons oblique; antennæ somewhat longer than fore wing and annulate; legs very long and slender; tibiæ with the spurs short; abdomen long and slender, with paired lateral tufts. Fore wing very long and narrow; veins 3, 4, 5 from angle of cell; 6 from below upper angle; 7 straight and well separated from 8, 9. Hind wing with veins 3, 4, 5 from angle of cell; 6, 7 from upper angle, 7 anastomosing with 8 to three-fourths of wing.

Fig. 160.



Lineodes hieroglyphalis, ♂. ½.

Type. (1) LINEODES HIEROGLYPHALIS Guen. Delt. & Pyr. p. 235, pl. 3. f. 6. Brazil.

(2) LINEODES CONTORTALIS Guen. Delt. & Pyr. p. 236. U.S.A.; Brazil.

(3) LINEODES INTEGRA Zell. Verh. z.-b. Wien, xxiii. p. 328, pl. iv. f. 44. U.S.A.; Brazil.

(4) LINEODES INTERRUPTA Zell. Verh. z.-b. Wien, xxiii. p. 329. Texas.

(5) LINEODES SERPULALIS Led. Wien. Ent. Mon. 1863, p. 417, pl. 15. f. 8. Brazil.

Auctorum.

Lineodes pulchralis Guen. Delt. & Pyr. p. 235. Brazil.

„ *triangulalis* Möschl. Abh. Senck. Ges. xvi. p. 305. Porto Rico.

„ *metagrammalis* Möschl. Abh. Senck. Ges. xvi. p. 305. Porto Rico.

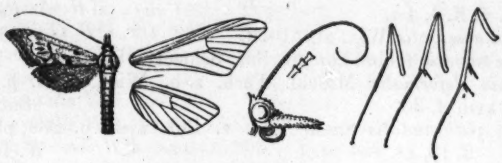
Genus 161. TINEODES.

Tineodes Guen. Delt. & Pyr. p. 236 (1854).
Carcantia Wlk. xvii. 424 (1858).

Palpi porrect, the 2nd joint three times length of head, thickly scaled, and with hair projecting from extremity extending as far as the short naked 3rd joint; maxillary palpi triangularly dilated with scales; frons roughly scaled; antennæ longer than the fore wing and annulate; legs very long and slender, the outer spurs half the length of inner. Fore wing very long and narrow; veins 3, 4, 5 well separated at origin; 6 from well below upper angle;

8, 9 stalked. Hind wing long and narrow; veins 3, 4 well separated at origin; 5 from middle of discocellulars; 6, 7 on a long stalk, 8 becoming coincident with 7.

Fig. 161.



Tineodes adactylalis, ♂. ½.

Type. TINEODES ADACTYLALIS Guen. Delt. & Pyr. p. 237, pl. 9. f. 7.
†*Carcantia pterophoralis* Wlk. xvii. 425. Australia.

GENERA AUCTORUM.

Acellalis iridalis Pag. J.B. Nass. Ver. xxxvii. p. 270, pl. vii. f. 7. Amboina.
Alyta calligrammalis Mab. Bull. Soc. Philom. (7) iii. p. 143. Madagascar.
Ancyloptila lactoides Pag. J.B. Nass. Ver. xxxix. p. 170, & Meyr. Trans. Ent. Soc. 1889, p. 509. Aru.
Barisoa intentalis Möschl. Abh. Senck. Ges. xiv. p. 83. Jamaica.
Berdura pupillalis Möschl. Abh. Senck. Ges. xiv. p. 78. Jamaica.
Catacteniza euvexalis Möschl. Abh. Senck. Ges. xvi. p. 314, f. 13. Porto Rico.
Cataonia monocerialis Rag. Ann. Soc. Ent. Fr. (6) x. p. 450. Armenia.
Clepsicosma iridia Meyr. Tr. N. Z. Inst. xx. p. 64. N. Zealand.
Crossophora miscellalis Möschl. Abh. Senck. Ges. xvi. p. 308. Porto Rico.
Decelia terrosalis Snell. Tidj. v. Ent. xxiii. p. 231, & xxvii. pl. iv. f. 1 *a*, *b*. Celebes.
Diaphantania conspicualis Möschl. Abh. Senck. Ges. xvi. p. 314. Porto Rico.
Enyocera latilimbalis Snell. Midd.-Sum. iv. (1) 8, p. 67. Sumatra.
Epimetasia vestalis Rag. Ann. Soc. Ent. Fr. 1894, pp. 173, 226. Persia.
„ *rhodobaphialis* Rag. Ann. Soc. Ent. Fr. 1894, pp. 173, 226. C. Asia.
Gonocausta zephyralis Led. Wien. Ent. Mon. 1863, p. 436. Amboina.
Hercynella staudingeri Beth. Baker, Ent. Mag. xxix. p. 204. N. Persia.

Hercynella margelana Beth. Baker, Ent. Mag. xxix. p. 205. N. Persia.
Hialopsis compositalis Led. Wien. Ent. Mon. 1863, p. 358, pl. 8. f. 3. Brazil.
Lampridia fuliginalis Snell. Tijd. v. Ent. xxiii. p. 234, & xxvii. pl. 4. ff. 4, 4 *a*. Celebes.
Motya abseusalis Wlk. xix. 1022. Brazil.
Pelæa ramalis Hübn. Samml. Eur. Schmett., Pyr. f. 92. Italy.
Pilemia deformalis Möschl. Verh. z.-b. Wien, xxxi. p. 427, pl. xviii. f. 36. Surinam.
Psara pallicaudalis Snell. Tijd. v. Ent. xviii. p. 239, pl. xiii. ff. 13, 14. W. Indies.
„ *selenialis* Snell. Tijd. v. Ent. xxxviii. p. 146, pl. vi. f. 5. Java.
Rapoona tristis Hedemann, Stett. Ent. Zeit. lv. p. 293. St. Thomas.
Somatania pellucidalis Möschl. Abh. Senck. Ges. xvi. p. 301, f. 22. Porto Rico.
Syndicastis heteromima Meyr. Trans. Ent. Soc. 1889, p. 507. N. Guinea.

APPENDIX.

List of Species omitted.

Ædiodes bacisalis Wlk. xix. 935. Type lost.
Asopia niobesalis Wlk. xix. 939. Type lost.
Acripia subolivacea Wlk. xxvii. 9, belongs to the *Noctuidæ*.
Audia mixtalis Wlk. xxvii. 18. Type lost.
Acrobasis latiorella Wlk. xxvii. 29, belongs to the *Noctuidæ*.
Arrade erebusalis Wlk. xxvii. 82, belongs to the *Deltoidinæ*.
Adricara albodiscata Wlk. xxvii. 115, belongs to the *Tineidæ*.
Adra argentilinea Wlk. xxvii. 138, belongs to the *Noctuidæ*.
Arsacia saturalis Wlk. xxxiv. 1260, belongs to the *Noctuidæ*.
Arsisaca bolinalis Wlk. xxxiv. 1262, belongs to the *Noctuidæ*.
Abacena discalis Wlk. xxxiv. 1270, belongs to the *Acontiinæ*.
Asopia depressalis Wlk. Trans. Ent. Soc. (3) i. 122. Type lost.
Acrobasis cryptoleucella Wlk. xxxv. 1709, belongs to the *Tineidæ*.
„ *atratella* Wlk. xxxv. 1712, belongs to the *Tineidæ*.
Archanara nonogrisella Wlk. xxxv. 1737, belongs to the *Noctuidæ*.
Andrapha basalis Wlk. xxxv. 1742, belongs to the *Sarrothripinæ*.
Banassa rutilans Wlk. xxvii. 20, belongs to the *Sarrothripinæ*.
Beara dichromella Wlk. xxxv. 1703, belongs to the *Noctuidæ*.
„ *nubiferella* Wlk. xxxv. 1704, belongs to the *Noctuidæ*.
Botys pyrrhusalis Wlk. xviii. 600. Type lost.
„ *niavialis* Wlk. xviii. 611. Type lost.
„ *lysanderalis* Wlk. xviii. 603. Type lost.
„ *dryopealis* Wlk. xviii. 672. Type lost.
„ *nephealis* Wlk. xviii. 673. Type lost.
„ *myrinalis* Wlk. xviii. 673. Type lost.

Botys brevilinealis Wlk. xviii. 674. Type lost.
„ *thaisalis* Wlk. xviii. 674. Type lost.
„ *dialis* Wlk. xviii. 675. Type lost.
„ *annulalis* Wlk. xviii. 675. Type lost.
„ *phycidalis* Wlk. xviii. 675. Type lost.
„ *theialis* Wlk. xviii. 689. Type lost.
„ *acilialis* Wlk. xix. 988. Type lost.
„ *polyclealis* Wlk. xix. 998, belongs to the *Geometridæ—Gymnoscelis*.
„ *nesusalis* Wlk. xix. 991. Type lost.
„ *aquilalis* Wlk. xxxiv. 1395. Type lost.
„ *tortipennis* Wlk. xxxiv. 1395. Type lost.
„ *bilunulalis* Wlk. xxxiv. 1398, belongs to the *Noctuidæ*.
„ *longalis* Wlk. xxxiv. 1403. Type lost.
„ *interruptalis* Wlk. xxxiv. 1406. Type lost.
„ *canalis* Wlk. xxxiv. 1429. Type lost.
„ *columbalis* Wlk. xxxiv. 1454. Type lost.
„ *acuminatalis* Wlk. xxxiv. 1454. Type lost.
„ *imparatalis* Wlk. xxxiv. 1416, is a Geometer = *Chlorochystis recensitaria* Wlk.
„ *disparalis* Wlk. xxxiv. 1438, is a *Cirrhochrista* near *semibrunnea* Hmpsn., *Schœnobiinæ*.
„ *semifœdalis* Wlk. xxxiv. 1439, belongs to the *Galleriinæ*.
„ *graminalis* Herr.-Schäff. Ver. Regens. Corresp.-Blatt, xxv. p. 18; *geminatalis*, *germanalis*, *episcopalis*, p. 19; *glirialis*, *gracilalis*, *harpalis*, *semifulvalis*, p. 20; *subviolalis*, *subaurantialis*, *subhyalinalis*, *tiliaralis*, p. 27; *hesperialis*, *idonealis*, p. 28; *dilutalis*, *illepidalis*, *impeditalis*, *impulsalis*, *impuralis*, *infixalis*, p. 29; *lualis*, p. 30. Types lost; descriptions inadequate. From Cuba.
„ *immaculalis* Hulst, Tr. Am. Ent. Soc. xiii. p. 154, is not a Pyrale.

Cavifrons biundulalis Zell. Verh. zool.-bot. Ges. Wien, 1872, p. 502, pl. iii. f. 14, from U.S.A., is a Noctuid.
Cataclysta bisectalis Wlk. xvii. 449, belongs to the *Acontiinæ*.
Clettharra valida Wlk. xxvii. 101, belongs to the *Sarrothripinæ*.
Characoma albulalis Wlk. xxvii. 107, belongs to the *Noctuidæ*.
Colubatha metaspilalis Wlk. xxvii. 126, belongs to the *Acontiinæ*.
Cophanta funestalis Wlk. xxx. 964, belongs to the *Acontiinæ*.
Cyiza punctalis Wlk. xxx. 965. Type lost.
Chlumetia guttiventris Wlk. xxxiv. 1271, belongs to the *Sarrothripinæ*.
Cossedia erateinalis Wlk. xxxiv. 1277. Type lost.
Cœsa viduella Wlk. xxxv. 1729, belongs to the *Nolinæ*.
Cutina albopunctella Wlk. xxxv. 1735, belongs to the *Noctuidæ*.
Cretonia platyphœella Wlk. xxxv. 1736, belongs to the *Sarrothripinæ*.
Cœnostola quadrifenestralis Herr.-Schäff. Ver. Regens. Corresp.-Blatt, xxv. p. 21; from Cuba. Type lost.

Diasemia completalis Wlk. xxxiv. 1327. Type lost.
Daraba vitellialis Wlk. xvii. 386, belongs to the Deltoids. Genus *Arrade*.
Dosara lapsalis Wlk. xix. 829, belongs to the *Phycitinæ—Ancylodes*.
Davara azonaxsalis Wlk. xix. 1020, belongs to the *Phycitinæ—Phycita*.
Dantona busalis Wlk. xix. 1021, belongs to the *Noctuidæ*.
Davana phalantalis Wlk. xix. 831. Type lost.
Desmia acriasalis Wlk. xix. 934. Type lost.
Daulia indecora Wlk. xxvii. 5, belongs to the *Cossidæ*.
Derchis horridalis Wlk. xxvii. 7. Type lost.
Dapha valeusalis Wlk. xxvii. 125, belongs to the *Tineidæ*.
Docela vetustalis Wlk. xxxiv. 1258, belongs to the *Acontiinæ*.
Desmia crudalis Wlk. xxxiv. 1296. Type lost.
Deuterollyta majuscula Herr.-Schäff. Ver. Regens. Corresp.-Blatt, xxv. p. 17; from Cuba. Type lost.
Desmia sertorialis, impuralis, quadrinotalis, p. 24; *personalis, pervialis*, p. 25: Herr.-Schäff. Ver. Regens. Corresp.-Blatt, xxv.; from Cuba. Types lost, descriptions inadequate.
Ebulea camillalis Wlk. xviii. 749. Type lost.
Egone bipunctalis Wlk. xxvii. 4, belongs to the *Noctuidæ*.
Evia ferrinalis Wlk. xxvii. 89, belongs to the *Noctuidæ*.
Enispa eosarialis Wlk. xxxiv. 1275. Type lost.
Ennychia crassalis Wlk. xxxiv. 1289. Type lost.
Ertrica purpurealis Wlk. xxxiv. 1343. Type lost.
Enopa mediella Wlk. xxxv. 1740. Type lost.
Epiecia externella Wlk. xxxv. 1740. Type lost.
Gyrtona pardalina Wlk. xxvii. 91, belongs to the *Lithosiinæ*.
„ *suffusa* Wlk. xxvii. 99, belongs to the *Deltoidinæ*.
„ *proximalis, ferrisiusalis, divitalis, conglobalis, semicarbonalis, rotundalis, hylusalis, nigrocinerea, inclusalis, costella, dorsifascialis, strenualis, thoracia, monilalis, spilalis*, and *dorsalis*, Wlk. xxvii. 90–98, belong to the *Noctuidæ*.
Gargaza tristrigella Wlk. xxxv. 1734, belongs to the *Sarrothripinæ*.
Gabara subnivosella Wlk. xxxv. 1740, belongs to the *Sarrothripinæ*.
Gorama strenuella Wlk. xxxv. 1749. Type lost.
Hibita arcturella Wlk. xxvii. 10, belongs to the *Noctuidæ*.
Hypochalcia pyralinalis Wlk. xxvii. 45. Type lost.
„ *perlignealis* Wlk. xxvii. 46, belongs to the *Noctuidæ*, genus *Gyrtona*.
„ *repugnalis* Wlk. xxvii. 47, belongs to the *Deltoidinæ*.
Hamaxia lignulina Wlk. xxvii. 128, belongs to the *Deltoidinæ*.
Homœosoma bilituralis Wlk. xxx. 955. Type lost.
Hisbanda acronyctoides Wlk. xxxiv. 1268. Type lost.
Herbula submarginalis Wlk. xxxiv. 1284, belongs to the *Tineidæ*.
„ *multiferalis* Wlk. xxxiv. 1286, belongs to the *Tineidæ*.
Hydrocampa dispulsalis Wlk. xxxiv. 1341. Type lost.
„ *inornata* Wlk. xxxiv. 1341. Type lost.
„ *discoloralis* Wlk. xxxiv. 1342. Type lost.

Herbula determinata Wlk. Ent. v. p. 134. Type lost.
Hellula simplicalis Herr.-Schäff. Ver. Regens. Corresp.-Blatt, xxv. p. 17; from Cuba. Type lost.
Illice batialis Wlk. xix. 1019=*Scoparia stupidalis* xxxiv. 1497, is a Lithosid.
Iambia inferalis Wlk. xxvii. 109, belongs to the *Noctuidæ*.
Isopteryx canescens Wlk. xxxiv. 1318, belongs to the *Deltoidinæ*.
„ *favillalis* Wlk. xxxiv. 1319=*canescens*, belongs to the *Deltoidinæ*.
Lineodes peridialis Wlk. xix. 948. Type lost.
Lacipea muscocella Wlk. xxvii. 138. Type lost.
Lephana tetraphorella Wlk. xxxv. 1702, belongs to the *Noctuidæ*.
Letoa patulella Wlk. xxxv. 1738. Type lost.
Lineodes gracillalis, *multisignalis* Herr.-Schäff. Ver. Regens. Corresp.-Blatt, xxv. p. 22; from Cuba. Types lost.
Mella dymnusalis Wlk. xix. 1018=*Etiella zinckenella*, belongs to the *Phycitinæ*.
Maschane erratipennis Wlk. xxvii. 3, belongs to the *Notodontidæ*.
„ *simplex* Wlk. xxvii. 3, belongs to the *Notodontidæ*.
Motina æqualis Wlk. xxvii. 12, belongs to the *Noctuidæ*.
„ *disparalis* Wlk. xxvii. 13, belongs to the *Noctuidæ*.
Masoga panagralis Wlk. xxvii. 16. Type lost.
Marisba undulifera Wlk. xxvii. 17. Type lost.
Midea rectalis Wlk. xxvii. 21, belongs to the *Noctuidæ*.
Myelois marsyusalis Wlk. xxvii. 37. Type lost.
„ *basifuscalis* Wlk. xxvii. 38. Type lost.
Modunga palpigera Wlk. xxvii. 84, belongs to the *Deltoidinæ*.
Maliattha separata Wlk. xxvii. 86, belongs to the *Acontiinæ*.
Moca velutina Wlk. xxvii. 102, belongs to the *Tineidæ*.
„ *dentilinea* Wlk. xxvii. 103, belongs to the *Sarrothripinæ*.
Medava diminuens Wlk. xxvii. 113, belongs to the *Sarrothripinæ*.
Madoce leucocosmalis Wlk. xxvii. 117, belongs to the *Deltoidinæ*.
„ *lineatula* Wlk. xxvii. 118. Type lost.
Masthala favillalella Wlk. xxx. 962. Type lost.
Madiama nigroscitalis Wlk. xxx. 964. Type lost.
Molvina guttalis Wlk. xxxiv. 1267, belongs to the *Lithosiinæ*.
Macaduma tortricella Wlk. xxxv. 1705, belongs to the *Lithosiinæ*.
Monilia semicanella Wlk. xxxv. 1741, belongs to the *Tineidæ*.
Nephopteryx spoliata Wlk. xxvii. 63, belongs to the *Noctuidæ*.
„ *etolusalis* Wlk. xxvii. 64. Type lost.
„ *harpaxalis* Wlk. xxvii. 65. Type lost.
„ *cyllusalis* Wlk. xxvii. 65. Type lost.
„ *acisalis* Wlk. xxvii. 66=*Gyrtona hylusalis*—*Noctuidæ*.
„ *argiadesalis* Wlk. xxvii. 66. Type lost.
„ *œolusalis* Wlk. xxvii. 66. Type lost.
„ *rudisella* Wlk. xxvii. 70, belongs to the *Noctuidæ*, genus *Arrade*.
Nigramma quadratifera Wlk. xxvii. 77, belongs to the *Noctuidæ*.
Nanaguna breviuscula Wlk. xxvii. 85, belongs to the *Sarrothripinæ*.

Nanaguna stipata Wlk. xxvii. 86, belongs to the *Noctuidæ*.
Necla canioralis Wlk. xxvii. 100, belongs to the *Nolinæ*.
„ *concinnula* Wlk. xxvii. 100. Type lost.
Nachaba transversa Wlk. xxvii. 114, belongs to the *Sarrothripinæ*.
Nephopteryx phycisella Wlk. xxx. 957. Type lost.
„ *neglectalis* Wlk. xxx. 958. Type lost.
Niaccaba sumptualis Wlk. xxxiv. 1272, belongs to the *Deltoidinæ*.
Nagara phryganealis Wlk. xxxiv. 1378, belongs to the *Noctuidæ*.
„ *steirialis* Wlk. xxxiv. 1379, belongs to the *Noctuidæ*.
Nigetia formosalis Wlk. xxxiv. 1506, belongs to the *Nolinæ*.
Nabara limacodella Wlk. xxxv. 1706, belongs to the *Sarrothripinæ*.
Nephopteryx variella Wlk. xxxv. 1718. Type lost.
„ *demptella* Wlk. xxxv. 1721, belongs to the *Noctuidæ*.
Orthomecyna exigua Butl. E. M. M. xv. p. 271: belongs to the *Crambinæ* = *cupripennis* Butl. E. M. M. xix. p. 178; the genus is allied to *Platytes*.
„ *albicaudata* Butl. E. M. M. xix. p. 178: do.; do.
„ *aphanopis* Meyr. Tr. Ent. Soc. 1888, p. 227: do.; do.
Oratha significata Wlk. xxvii. 15, belongs to the *Geometridæ*.
Olulis puncticinctalis Wlk. xxvii. 127, belongs to the *Deltoidinæ*.
Orthaga pyralisalis Wlk. xxvii. 105. Type lost.
Pionea susialis Wlk. xviii. 760, belongs to the *Noctuidæ—Acontiinæ*.
Phazaca erosioides Wlk. xxvii. 21, belongs to the *Epiplemidæ*.
Pena costalis Wlk. xxvii. 130, belongs to the *Geometridæ*.
Pindicitora acreonalis Wlk. xxvii. 136. Type lost.
„ *annusalis* Wlk. xxvii. 136. Type lost.
Pontana rubrana Wlk. xxx. 954. Type lost.
Pardasena acronyctella Wlk. xxxv. 1730, belongs to the *Sarrothripinæ*.
„ *minorella* Wlk. xxxv. 1730, belongs to the *Sarrothripinæ*.
Rhodaria formosalis Wlk. xxxiv. 1284, belongs to the *Acontiinæ*.
Scoparia stupidalis Wlk. Tr. Ent. Soc. (3) i. p. 127, belongs to the *Lithosiinæ* = *Illice batialis* Wlk. xix. 1019.
Scopula hastiferalis Wlk. xxxiv. 1473, belongs to the *Crambinæ* = *Culladia admigratella* Wlk.
Salbia lenalis Wlk. xvii. 362. Type lost.
Silda truncatalis Wlk. xxvii. 131, belongs to the *Noctuidæ*.
Scopula comptalis Wlk. xxxiv. 1462, belongs to the *Deltoidinæ*.
„ *limasalis* Wlk. xxxiv. 1464. Type lost.
„ *fœdalis* Wlk. xxxiv. 1466, belongs to the *Deltoidinæ*.
„ *nexalis* Wlk. xxxiv. 1473. Type lost.
„ *arcuatalis* Wlk. xxxiv. 1474, belongs to the *Tortricidæ*.
„ *figuralis* Wlk. xxxiv. 1475, belongs to the *Noctuidæ*.
„ *vinctalis* Wlk. xxxiv. 1476, belongs to the *Noctuidæ*.
„ *pulverosalis* Wlk. xxxiv. 1478, belongs to the *Deltoidinæ*.
„ *variabilis*, *flexifera*, *serpentina*, *effrenata*, *includens*, *inscita*, and *submarginalis*, Wlk. Ent. v. pp. 151–153, from the Red Sea. Types lost.

Symitha nolalella Wlk. xxxv. 1731, belongs to the *Sarrothripinæ*.
Subrita abrostolella Wlk. xxxv. 1744, belongs to the *Noctuidæ*.
„ *bilineatella*, *curviferella*, *latifasciella*, *metaspilella*, *parvella*, *circulella*, and *basigerella*, Wlk. xxxv. 1744–48, belong to the *Sarrothripinæ*.
Torone hyblæoides Wlk. xxvii. 6, belongs to the *Sarrothripinæ*.
Tipasa nebulosella Wlk. xxvii. 129, belongs to the *Deltoidinæ*.
Tirathaba mundella Wlk. xxx. 961, belongs to the *Gallerianæ*.
Tomissa fervidella Wlk. xxx. 979. Type lost.
Tribunta scabralis Wlk. xxxiv. 1507, belongs to the *Nolinæ*.
„ *biguttalis* Wlk. xxxiv. 1507, belongs to the *Nolinæ*.
Toiana venosella Wlk. xxxv. 1732, belongs to the *Lithosiinæ*.
Tamusida vittalis Wlk. xxxv. 1733, belongs to the *Sarrothripinæ*.
Vinzela inaptalis Wlk. xxxiv. 1261. Type lost.
Zebronia cœliusalis Wlk. xix. 966. Type lost.
„ *bialis* Wlk. xix. 968. Type lost.
Zia tactalis Wlk. xxvii. 110, belongs to the *Nolinæ*.
Ziza ostentalis Wlk. xxvii. 119, belongs to the *Deltoidinæ*.
Zuncacetha bipartita Wlk. xxvii. 134, belongs to the *Geometridæ*.
Zitna albicinctalis Wlk. xxxiv. 1277. Type lost.
Zebronia discerptalis Wlk. xxxiv. 1348. Type lost.
„ *teneralis* Wlk. xxxiv. 1345, belongs to the *Deltoidinæ*.

March 7, 1899.

Prof. G. B. Howes, LL.D., F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of February 1899:—

The total number of registered additions to the Society's Menagerie during the month of February was 112, of which 31 were by presentation, 6 by birth, 43 by purchase, and 32 on deposit. The total number of departures during the same period by death and removals was 104.

Amongst the additions special attention may be called to the fine series of Cassowaries deposited by the Hon. Walter Rothschild, F.Z.S., which now embraces examples of the following eight species:—*Casuarius bicarunculatus*, *C. australis*, *C. salvadorii*, *C. beccarii*, *C. violicollis*, *C. occipitalis*, *C. bennetti*, and *C. papuanus*.

In exhibiting specimens of the freshwater Jellyfish (*Limnocnida tanganjicæ*), from Lake Tanganyika, Mr. J. E. S. Moore said that

the animals themselves were by no means new to science. They had been recorded from the Lake by Boehm in 1887. They had also been seen by Mr. Muir, and obtained by him, and their anatomy described by Mr. R. T. Günther[1]. But, notwithstanding this, the Medusa was of perennial interest, in that it is, with the exception of *Limnocodium*, the single representative of a true freshwater Jellyfish. All the other instances which had been recorded of Jellyfish inhabiting freshwaters had turned out to be examples of the fact that Jellyfish could migrate, under certain circumstances, considerable distances from the sea, just in the same way that Crabs and Prawns and flat-fish were sometimes found far up the estuaries of rivers beyond the tidal range. Nevertheless, all these organisms were typically marine, and the very last place where anyone would have looked for Jellyfish was Lake Tanganyika, on the top of the interior African plateau, and 700 miles from the sea.

Mr. Moore himself had observed the Jellyfish early in March, and shortly afterwards they began to increase rapidly by budding, so that in a few weeks the bays and open waters of the Lake were filled with immense swarms of Medusæ. The buds on the manubrium became detached in strings and shreds in such a manner as to curiously resemble minute siphonophores.

About June or July the budding ceased, and shortly afterwards ciliated embryos appeared in great quantities, which developed into small Medusæ exactly like the buds, and towards September all reproductive activity appeared to have come to an end. It thus appeared that the life-cycle of *Limnochnida* was complete without the introduction of any hydroid stage, and accordingly, although a most careful search had been made among the débris on the bottom of the Lake, upon the shells of molluscs, and upon the appendages of crabs and other Crustacea, no hydroid had ever been found. Hence it was inferred that the various surmises which have been put forward respecting the possibility of *Limnochnida* being related to the Macro-Medusæ were probably true.

Mr. W. E. de Winton, F.Z.S., exhibited and made remarks upon the tail of a Common Fox (*Canis vulpes*), showing the gland on the upper surface covered with straight coarse hair, which appeared to be little known. This gland, which emitted an aromatic odour, was found in all the Canidæ, with possibly the exception of *Lycaon pictus*. Although the bases of the hairs covering the gland were usually almost white, the tips were always black; this colour generally extended to the surrounding hairs, and often formed dark bars on the buttocks. The dark spot on the dorsum of the tail was particularly conspicuous, notably in such widely separated species as the Wolves, Azara's Dog, and the Fennec.

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[1] See Ann. & Mag. N. H. ser. 6, xi. p. 269.

BRITISH
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Mr. Arthur Thomson, the Assistant-Superintendent of the Gardens, laid on the table a series of specimens of various Insects reared and exhibited in the Insect-house in the Society's Gardens during the past year, and read the following report on the subject:—

Report on the Insect-house for 1898.

Examples of the following species of Insects have been exhibited in the Insect-house during the past season:—

Silk-producing Bombyces and their Allies.

Asiatic.

Attacus atlas.
—— *cynthia.*
—— *ricini.*
*—— *pryeri.*
Caligula japonica.
**Rhodia fugax.*
Antheræa mylitta.
Antheræa yama-mai.
—— *pernyi.*
**Actias leto.*
—— *selene.*
*—— *artemis.*
Cricula trifenestrata.

American.

Attacus hesperus.
Samia cecropia.
—— *ceanothi.*
Telea polyphemus.
—— *promethea.*
Hypochera io.
**Automeris rubrescens.*
Anisota stigma.
Eacles imperialis.
—— *regalis.*

African.

Actias mimosæ.
Gynanisa isis.
Cirina forda.
**Lebeda koellikeri.*

Diurnal Lepidoptera.

European.

Papilio podalirius.
—— *machaon.*
Doritis apollinus.
Thais polyxena.
—— *cerisyi.*
Charaxes jasius.

American.

Papilio zolicaon.
—— *asterias.*
—— *ajax.*
Papilio troilus.
Limenitis disippus.

Nocturnal Lepidoptera.

Acherontia atropos.
Sphinx ligustri.
—— *pinastri.*
—— *carolina.*
Ceratomia undulosa.
—— *amyntor.*
Smerinthus ilicæ.
—— *ocellatus.*
—— *myops.*
Smerinthus excæcatus.
Philampelus achemon.
Deilephila vespertilio.
—— *galii.*
—— *euphorbiæ.*
—— *nicæa.*
—— *alecto.*
—— *elpenor.*
Darapsa myron.

* Exhibited for the first time.

Of the Lepidopterous Insects which I have the honour to place before the meeting, *Attacus pryeri*, *Actias artemis*, *Rhodia fugax*, from Japan, *Actias leto* (females), from the Himalayas, and *Automeris rubrescens*, from Buenos Ayres, were exhibited for the first time during the past season.

I have received during the past three years cocoons of the beautiful Indian Moth *Actias leto* (the female of which is known as *Actias mænas*); but with the exception of the last consignment (which was received on Dec. 26th) all the Moths emerged *en route*, and in this case I found that *all* the males had emerged. The box in which the cocoons were packed, being made of tin, was badly crushed in the post, but I was pleased to find that eleven cocoons contained living pupæ. They were immediately placed in the Insect-house, and on the 28th of December a fine and perfect specimen of the Moth emerged, and the remainder during the next fortnight. Three of the cocoons produced specimens of *Actias selene*. I regret to say that with the exception of the two perfect specimens which I exhibit this evening, and two others not quite perfect, all the Moths that emerged were useless cripples. This is, however, I believe, the first time that this species has been exhibited in Europe alive.

The specimens of *Rhodia fugax* were reared from ova received from Japan. The larvæ fed well upon sallow and plum, and in due time spun their curious cocoons, some of which I exhibit, together with a sketch of the larva. When the Moths emerge they soften the opening of the cocoon, but, as will be seen, they harden again afterwards, and the cocoons have the same appearance as before the Moths emerged. The larvæ of this Moth make a curious squeaking noise when disturbed.

Together with the cocoons of *Actias mimosæ*, which we received from Delagoa Bay, was a small smooth cocoon. From this emerged the female specimen of *Lebeda koellikeri*, which I exhibit this evening. I have set the Moth in exactly the same position as that in which it rested on the virgin cork in the case, so as to show the curious shape of the upper margin of the under-wings.

During the past season several specimens of the Goliath Beetle (*Goliathus druryi*) were received, but did not live very long. A specimen of "Rhinoceros" Beetle (*Oryctes boas*), from Port Elizabeth, was presented by Miss Matcham and Captain Travers on February 24, and lived till August 5. The specimen (which I exhibit) used to burrow in the sand very rapidly, and when doing so laid its horn back in the manner shown in the "setting." When walking about above the ground it carried the horn upright or nearly so. Its principal food was bananas.

One of the most remarkable inmates of the Insect-house at the present time is a very fine specimen of the Giant Centipede (*Scolopendra gigas*), from Trinidad, which was presented by Mr. R. R. Mole, July 7, 1898 (see P. Z. S. 1898, p. 587).

This Centipede, on arrival at the Gardens, was in rather poor condition, but it fed voraciously twice a week, and entirely con-

sumed a white mouse each time it fed. It improved rapidly, and after the first three weeks it fed only once a week, and it will now go for a fortnight without feeding. When a mouse is put in the Case the Centipede rears up upon its hinder legs and seizes the mouse immediately, behind the head, with its strong mandibles and the anterior five or six pair of legs. The mouse soon dies, no doubt from the Centipede's poisonous bite.

Mr. R. E. Holding exhibited and made remarks upon the horns of a Muntjac from Singapore, which greatly exceeded in size and weight those of the Indian Muntjac (*Cervulus muntjac*), the only species with which they could be compared. The horns exhibited (B), though distinctly cervuline in their general character, indicated considerable difference from the normal form of Muntjac horns, being 9 inches in length, the brow-tine $4\frac{3}{4}$ inches long, girth of

A. Indian Muntjac. B. Specimen exhibited.

"pedicle" $3\frac{1}{2}$ inches,—the Indian Muntjac horns seldom exceeding $6\frac{1}{2}$ inches, the brow-tine not more than $1\frac{1}{2}$ inch. The thickness and shortness of the pedicle, the width across the facial ridge, with other osteological characters, seemed to indicate an animal much larger, if not entirely distinct from the Indian species with which it was compared.

The following papers were read:—

1. On the Chimpanzees and their Relationship to the Gorilla.

By Arthur Keith, M.D., F.Z.S.

[Received March 7, 1899.]

(Plate XX.)

At the present time there is in the Menagerie of Messrs. Barnum and Bailey an adult female anthropoid ape, known by the name of "Johanna," regarded by its owners as a Gorilla, but which, there can be no doubt, is in reality a Chimpanzee. No difficulty has ever been experienced in distinguishing between the male Gorilla and the male Chimpanzee, nor between the females when an anatomical investigation has been possible; but on several occasions, as in the case of this Ape, living female Chimpanzees have been mistaken for Gorillas. There is the classical case of "Mafuka,"[1] of the Dresden Zoological Garden. "Johanna" shares all the features of "Mafuka"; she answers to the description given by Du Chaillu of the species he names "*Troglodytes kooloo-kamba*"[2]. The animal dissected and described by Gratiolet and Alix[3] under the name of *T. aubryi* was also of the same variety. "Johanna" is of interest because she represents a variety of Chimpanzee which approaches the Gorilla in so many points that it is evident the characters which separate the two African anthropoids are not so well marked as many suppose. The difficulty of distinguishing the one from the other, as shown by a recent communication by Mr. Duckworth[4] to this Society, is such that it has become necessary to sum up, from a much wider examination of material than has ever been at anyone's disposal before, the structural and physiological differences which separate the Gorilla from the Chimpanzee, and at the same time to sum up the evidence as to the existence of one or more species of Chimpanzee. Some five years ago, on working minutely over all the anthropoid material in the collections of the Natural History Museum at South Kensington and the Museum of the Royal College of Surgeons, which contain the skulls of 31 Gorillas, 44 Chimpanzees, 73 Orangs, and 56 Gibbons, I was struck by the fact that nearly all the characters which had been used to differentiate species were points which varied in structure and form with age, sex, and the individual, but I have never had any difficulty in distinguishing between the skulls, even of fœtal Gorillas and Chimpanzees.

1. *The Eruption of the Permanent Teeth in Chimpanzees.*

Mr. Duckworth has promised the Society a full description of "Johanna," but I learned certain facts from her keeper,

[1] Keith. 'Introduction to the Study of Anthropoid Apes,' pp. 8, 23. London, 1897.

[2] Du Chaillu. 'Explorations and Adventures,' 1861, p. 360.

[3] Gratiolet et Alix. "Recherches sur l'Anatomie du *Troglodytes aubryi*," Nouv. Archiv. du Mus. Hist. Nat. 1866, t. ii. pp. 1–263.

[4] W. L. H. Duckworth. P. Z. S. 1898, p. 989.

J. Smit del. et lith.

Mintern Bros. imp.

ANTHROPOPITHECUS TROGLODYTES KOOLOO-KAMBA, ♀.

(JOHANNA)

BRITISH
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Mr. Mackay, whom I believe to be reliable, adding so considerably to our knowledge of the habits of the Chimpanzee that I wish to give them here.

She is, so far as I know, the first Chimpanzee that has ever lived long enough in captivity to complete its permanent dentition. All her permanent teeth have cut, with the doubtful exception of the third molar on one side, and it becomes important to determine her age so as to ascertain the period of life at which these animals attain a complete set of permanent teeth. Man attains his about the twenty-second year, but the Chimpanzee evidently much earlier. Johanna has been twelve years in captivity—six years in Messrs. Barnum and Bailey's Menagerie, six years in the Zoological Gardens at Lisbon; and we may infer, as it is the common age, that she was one or two years old when Portuguese traders brought her there from the West Coast of Africa, probably Loango. When she came into his care six years ago, Mr. Mackay is positive she had then cut all her permanent incisors. From the appearance of the third molars, I think the permanent dentition has been completed very recently, so that we may accept the 12th or 13th year as the terminal period of the Chimpanzee dentition. As is usual in the female Chimpanzee, the canine teeth cut before the last molars. There are only two other records of the period at which the Chimpanzee teeth erupt. One is the case of "Sally"[1]. She was probably ten years of age when she died; the permanent premolars had cut, but the canines and the second and third molars had not appeared. Ehlers[2] also records the case of a Chimpanzee in which the permanent dentition was being completed about the 11th or 12th year by the eruption of the canine and last molar when the animal died.

2. *Menstruation.*

Little is known concerning the menstruation of the Anthropoids. The only observation is that of Ehlers[2], of a Chimpanzee which began to menstruate about the tenth year, and continued, until it died two years later, to show a monthly discharge. Mr. Mackay's observation on "Johanna" verifies Ehler's statement; she began to show a monthly discharge when she was believed to be ten years old. The discharge appears every 28th day, and lasts for three days. It is sanguineous in colour, profuse, amounting to perhaps 4 or 6 oz., staining freely her skirt. She is then very irritable. For 6 to 8 days before the discharge appears she is in heat, the genital labia are turgid and swollen; the nipples are fuller and more erect. When the discharge appears, the state of turgescence in the pudendal organs passes away. She shows a friendly disposition to men rather than to women. She frequently plays with her nipples, but has

[1] Beddard, F. "Contributions to the Anatomy of the Anthropoid Apes," Trans. Zool. Soc. Lond. 1892, vol. xiii. pp. 177–218.

[2] Eilers, P. "Beiträge zur Kenntniss des Gorilla und Chimpanse," Abh. phys. Cl. Ges. Wiss. Göttingen, 1881, Bd. xxviii. No. 1, 77 pp., 4 pls.

acquired no degenerate sexual habits. The sexual state, so far as Mr. Mackay has observed, does not change with the season of the year. Of menstruation in the Gorilla, nothing is known.

3. *The Relationship of the Chimpanzee to the Gorilla.*

An examination of all the structural systems of the African Anthropoids leads to the inference that the Gorilla is the more primitive of the two forms, and approaches the common parent anthropoid more nearly than the Chimpanzee. The teeth of the Gorilla, individually and collectively, form a complete dentition, a dentition at the very highest point of development; the teeth of thh Chimpanzee show marked signs of retrogression in development of size and structure. The muscular development and the consequent bony crests for muscular attachment of the Gorilla far surpass those of the Chimpanzee. The muscular development of the adult Chimpanzee represents the system of the adolescent Gorilla. Some of the bodily organs of the Gorilla belong to a simpler and earlier primate type than those of the Chimpanzee. But in one point the Chimpanzee evidently represents more nearly the parent form—its limbs and body are more adapted for arboreal locomotion; of the two, the Gorilla shows the nearer approach to the human manner of locomotion. On the whole, the evidence at our disposal at the present time points to the fact that the Chimpanzee is a Gorilline derivative, in which, with a progressive brain-development, there have been retrograde changes in most of the other parts of the body. The various forms of Chimpanzee differ according to the degree to which these changes have proceeded.

4. *The Brain-development in the Chimpanzees and Gorilla.*

The temperament of the Gorilla and Chimpanzee is absolutely different. All the Gorillas of which we have any knowledge agree in being sullen, untamable, and ferocious, even the youngest of them. They do not tolerate confinement: only one has lived over a year in captivity in Europe; one is said to have been in the possession of an African chief for six years. The Chimpanzee, on the other hand, at any rate in its younger stages, takes to confinement easily, is teachable and playful. The elaborate toilet and performance gone through daily by "Johanna," the skilful way in which she decants her glass of wine, removing and replacing the stopper, declares her to be a Chimpanzee more clearly than any other character she could show. Her education is probably the most elaborate ever possessed by any ape. She appears to be colour-blind.

Du Chaillu states that the Chimpanzee to which he gives the name of *T. kooloo-kamba* had a distinctive cry; from her physical features "Johanna" appears to belong to that species. When in a fit of passion, into which she is easily thrown, the hair of the scalp becomes erect, she beats the floor with her feet and hands,

and utters a cry beginning with a low *hoo, hoo*, gradually raising it in volume to a loud climax. I do not think her cry differs from that of the young *Anthropopithecus niger* in character; what is peculiar in her cry may be put down to her more advanced age. The Chimpanzee cry is very different from the howl of the Gorilla; "Johanna" does not beat her breast, as the Gorilla does, when in temper. She allows her keeper, only, to handle her; she is vicious towards others and takes her revenge on an offender by suddenly throwing handfuls of litter at him from the floor of her cage. She has never been given an opportunity of manifesting any nest-building habit, and the experiment seems well worth trying. On making her escape on one occasion she was found carrying away large pieces of wood on her shoulder.

She is fed mostly on fruit. A day's rations consists of :—

2 dozen bananas.
1 „ oranges.
1 „ raw eggs.
½ „ apples.
Lemons.
Carrots.
Coffee, tea, port wine.
Toast and sandwiches.

When given an opportunity, she caught, plucked, and ate a sparrow, but she rejects no pellets from the stomach, as was the case with "Sally."

She sleeps on her side and spends the day sitting on a broad box, with her legs spread out in front and her arms on her belly.

There is a very marked difference between the size of the brain of the Gorilla and Chimpanzee. The average cranial capacity of seven adult female Gorillas I found to be 450 c.c.; of ten similar Chimpanzees 364 c.c.; but although the average is greater in the Gorillas, the highest of Chimpanzees exceeded the lowest of the Gorillas, so that the size of brain is not a feature that can be used to discriminate the one from the other. The average cranial capacity of six adult male Gorillas is 530 c.c.; of sixteen male Chimpanzees 405 c.c. The smallest Gorilla skull had a greater capacity than the largest Chimpanzee. The largest Chimpanzee skull measured 460 c.c. The cranial capacity appears to be diagnostic for the males of those animals. An important distinction appears in the size of the brain as in the general appearance of those Anthropoids; the sexual difference is much more marked in the Gorilla than in the Chimpanzee.

The cranial capacity of those animals, stated in c.c., may be taken as representing the brain-weight, stated in grammes[1]; but in comparing the relative size of the brains of the Gorilla and Chimpanzee a greater deduction has to be made from the brain of the Gorilla than from that of the Chimpanzee, owing to the much

[1] Keith. Journ. Anat. & Physiol. 1895, n. s., vol. ix. pp. 282–303.

greater body-weight of the former[1]. The weight of "Johanna" is 140 lbs. The greater cranial capacity of the Gorilla is marked before the end of the milk-dentition.

Cranial capacity does not help us to distinguish between the various forms of Chimpanzee. The skull of a male "Kooloo-kamba" brought home by Du Chaillu measures 420 c.c., rather more than the average capacity of the male Chimpanzee; four skulls of males brought by Emin Pasha from Central Africa average 422 c.c.; two females measured 378 c.c., showing distinctly a high average, and confirm in some degree the supposition that the Central-African form is a distinct variety: a male of the variety known as *A. calvus* measured 420 c.c.; two females averaged 368 c.c. These figures, so far as they go, show that the Chimpanzee, although widely spread, has not broken up into forms separated widely by a divergence in brain size.

5. *The Palate and Dentition of Gorillas and Chimpanzees.*

The size and shape of the hard palate, counting as the palate the whole area lying with the outer margin of the dental arcade, seem to me of great importance. The size and shape of the palate express better than other features the brute development of the race. The larger the relative size of the brain, the smaller the relative development of the palate. Its size and shape depend on the degree of development of the teeth. In an animal like the Gorilla, in which the dentition is complete and robust, the palate is extremely large and its length is much greater than its breadth. In the Chimpanzee at birth the breadth of the palate, as in Man, is greater than its length, whereas in the Gorilla the length is, even at birth, greater than the breadth. The development of the facial parts of the skull and of its bony crests depends on the size and shape of the palate.

As in the case of the cranial capacity, the palatal differences of the male Gorilla and Chimpanzee are very marked. The average palatal area of seven adult male Gorillas was 7200 mm.; the breadth was 63 per cent. of the length: the corresponding figures in 15 adult male Chimpanzees were, palatal area 4580 mm. and the breadth was 77 per cent. of the length. The maximum measurements in the Chimpanzees were less than the minimum measurements of the Gorillas. But the difference between the females was less marked; the palates of some Chimpanzees exceeded those of some Gorillas. Here, again, the palate affords no certain index as to the animal. But, on an average, the palate of the female Gorilla is much the larger: for 7 adult female Gorillas it was found to measure 5600 mm., the breadth being 73 per cent. of the length; in 11 female Chimpanzees the average area was 4200 mm., and the breadth 77 per cent. of the length. The figures quite bear out my opening statement that the brute development of the Gorilla, even in the female, is much greater than in the Chimpanzee.

[1] Dubois, E. "Ueber die Abhängigkeit des Hirngewichtes von der Körpergrösse beim Menschen," Archiv für Anthrop. 1898, Bd. xxv. p. 423.

The palate of the Central-African Chimpanzee most resembles that of the Gorilla. The average area for 3 males amounted to 4350 c.c., rather less than the ordinary Chimpanzee; the breadth is only 71 per cent. of the length—a very low amount. The skulls of *Anthropopithecus calvus* and *A. kooloo-kamba* are too few to draw inferences from, but in both the breadth index is over 80 per cent.

The difference in form and size of the teeth of Gorillas and Chimpanzees is very emphatically marked. The cusps of the molars of the Gorilla are extremely prominent, almost prismatic, with the enamel deposited in a sharp crystalline manner, with only round the bases of the cusps evidence of the crenated folds of enamel which form a pronounced character in the teeth of Chimpanzees. The cusps of the Chimpanzee are bluntly conical and not nearly so prominent as in the Gorilla. The crenation of the enamel is perhaps the most diagnostic feature of the great Anthropoids. Cusps resembling those of the Gorilla occur in the teeth of the Siamang and some South-American monkeys (*Brachyteles* and *Lagothrix*), and represent the molar cusp at its most robust development. The cusps of the Central-African Chimpanzee most resemble those of the Gorilla, but never approach them in degree of development.

The molar teeth of the Gorilla, as may be seen from the accompanying measurements, are very much larger than those of the Chimpanzee:—

	$m.^1$	$m.^2$	$m.^3$	$\overline{m.^1}$	$\overline{m.^2}$	$\overline{m.^3}$
Length of molar teeth, stated in mm., an average of both sexes of Gorilla...	14·6 (×14)	15·2	14·1	15	16	17
Do. Chimpanzee	10 (×10·5)	10·2	8	11·5	12	11

One may say, almost with certainty, that any upper molar tooth over 12 mm. in length is that of a Gorilla, and under 12 is that of a Chimpanzee. The molar teeth of the female Gorilla are almost as large as those of the male: the molars of the female Chimpanzee are smaller than those of the male and show more marks of retrogression: while the third molar of the Gorilla, especially the lower, is as fully developed as the other two teeth, the corresponding tooth in the Chimpanzee, as in Man, and as in the Orang, shows distinct retrograde changes. The table on p. 302, the result of the examination of 22 Gorilla and 26 Chimpanzee skulls, shows the retrograde development of the cusps in the Chimpanzee, especially in the third molar tooth.

The observations show that in point of size, in development of cusps, and in arrangement of enamel the teeth of the Gorilla far exceed those of the Chimpanzee, and, unlike former points of difference, the distinction between the molars of the females is as well drawn as between the molars of the males.

In every point the teeth of the Central-African Chimpanzee make the nearest approach to the Gorilla; the molars of the Bald Chimpanzee have probably undergone the most retrograde change.

Number of Cusps on the upper Molar Teeth of Gorillas and Chimpanzees.

	m.¹			m.²			m.³		
	4 cusps only.	Small 5th present.	Small 6th present.	4 only.	Small 5th.	Small 6th.	4 only.	Small 5th.	Small 6th.
Gorillas	100 p.c.	Freq. present.	.....	56 p.c.	43 p.c.	1 p.c.	20 p.c.	55 p.c.	25 p.c.
Chimpanzees	100 p.c.	.....	.....	85 p.c.	15 p.c.	.....	90 p.c.[4]	10 p.c.	

[4] 4th cusp was very much reduced in size in over 50 per cent.

Number of Cusps on the lower Molar Teeth of Gorillas and Chimpanzees.

	$\overline{m.^1}$			$\overline{m.^2}$			$\overline{m.^3}$		
	4 cusps only.	5th.	6th.	4 only.	5th.	6th.	4 only.	5th.	6th.
Gorillas	10 p.c.	90 p.c.	.....	.....	80 p.c.	20 p.c.	.....	70 p.c.	30 p.c.
Chimpanzees	.....	90 p.c.	10 p.c.	.....	80 p.c.	20 p.c.	25 p.c.	65 p.c.	10 p.c.

The differences between the premolar teeth of the Gorilla and Chimpanzees are even more marked than between the molars, and these teeth will probably afford the best clue to the identification of different races of Chimpanzee. The premolars of the Gorilla are much larger than those of the Chimpanzee and show very little individual variation.

The average Length of the Premolars in Gorillas and Chimpanzees.

	pm.¹	pm.²	$\overline{pm.^1}$	$\overline{pm.^2}$
Gorilla	10 mm.	10 mm.	16 mm. (male). 14 mm. (female).	11 mm. 11 mm.
Chimpanzee	7·5 mm.	7 mm.	10 mm. (male). 9 mm. (female).	8·5 mm. (male). 7·5 mm. (female).

The most characteristic feature of the Gorilla, male and female alike, is the great development of the first lower premolar tooth. To a certain extent this is dependent on the great development of their canines. The upper premolars of the Gorilla are of equal size; in the Chimpanzee the second premolar is, with occasional exceptions, less than the first and shows in the size of its cusps and the union of its fangs signs of a retrograde development. A feature of the Central-African Chimpanzee is the relative small size of its second premolars, both upper and lower; there is not

enough of material to make any statement as to their development in *Anthropopithecus calvus* and *A. kooloo-kamba*. The premolars of the Chimpanzee although differing in size, do not differ much in the number and arrangement of their cusps.

The canine teeth have attained their greatest development amongst the large Anthropoids in the Gorilla. Their large size expresses the ferocity of the animal. The sexual difference between the canines of the male and female is much greater in the Gorilla than in the Chimpanzee: the canines of the male Chimpanzee equal in their development those of the female Gorilla. The upper canines of the male Gorilla project 14–18 mm. above the other teeth; their antero-posterior diameter varies from 18–20 mm.; the lower project above the premolar teeth from 8–10 mm. The development of the upper canines of the male Chimpanzee is much less than those of the Gorilla: the upper projects 8–12 mm. with an antero-posterior diameter of 12–15 mm.; the lower reaches above the other teeth from 4–6 mm. In the female Gorilla the upper canines reach above the other teeth from 8–10 mm.; the corresponding measurement in the Chimpanzee is from 6–8 mm.: in the lower teeth, the canines of the Gorilla project 4–6 mm.; in the Chimpanzee seldom more than 3 mm. The size of the canine teeth helps in the diagnosis of the Chimpanzee.

The incisor teeth of the Gorilla are a fourth larger than those of the Chimpanzee, but the relative size of the individual incisors is almost the same. The upper lateral incisors, owing to the great size of the canines, are relatively small in the Gorilla. The arrangement of the cuspules of enamel on the teeth of the one is different from that of the other, but the small amount of material at my disposal precludes me from making any more definite statement.

In both the Chimpanzee and Gorilla the last permanent and canine teeth commonly cut together; but in the Chimpanzee the canine cuts more frequently before the last molar than in the Gorilla.

"Johanna" has the habit of yawning frequently, when a full view is got of her teeth, and there cannot be a doubt for an instant that in every point she possesses the dentition of a female Chimpanzee.

I know of four instances of supernumerary molars in the Gorilla. I know of only one in the Chimpanzee, and yet Chimpanzee skulls are three times more numerous than those of the Gorilla.

6. *The Myological and Osteological Differences in the Bodies and Limbs of the Gorilla and Chimpanzee.*

It is a very remarkable fact, and one that very forcibly proves the close relationship between the Gorilla and Chimpanzee, that there is scarcely a feature in any muscle or bone found in one animal which is not also found in the other. What is the exception in the one, frequently proves the rule in the other, and

it is only by dealing with a large number of the two races that their essential characteristics can be arrived at. The statements made here, concerning the arrangement of muscles, are founded on accounts more or less complete of the dissections of 13 Gorillas and 30 Chimpanzees. When the osteological and myological differences that separate the Chimpanzee and Gorilla are analyzed it is found that they all centre round the adaptation of the Chimpanzee for a life almost completely arboreal, while in the Gorilla they indicate an adaptation for spending a life in the open as well as on trees. In short, the body of the Gorilla is more adapted for the human manner of progression than that of the Chimpanzee.

The approach to plantigrade progression is seen in the development of the heel and calf-muscles of the Gorilla. The os calcis projects behind the astragalus, to serve as a lever for the soleus and gastrocnemius, twice as far in the Gorilla as in the Chimpanzee. The projection in the Chimpanzee is always less than 1·5 cm.; it is never less than 3·5 cm. in the adult Gorilla. The soleus, too, shows a much greater tendency in the Gorilla than in the Chimpanzee to assume the form found in Man. It had acquired an origin from the tibia in 3 out of 8 Gorillas and in only 2 out of 12 Chimpanzees, while in the Gorilla the soleus resembles to some extent the human arrangement by being more closely fused with the tendon of the gastrocnemius.

As a grasping-organ, made up of two limbs, a hallucial limb on the one side and a digital limb on the other, the foot of the Gorilla does not differ materially from that of the Chimpanzee. The proportional length of these limbs to each other and to the lower extremity, as seen in the skeleton, are alike in both. The muscles that act on them, except in minor details, are almost alike. The foot of the Gorilla is the more bulky, broader, and the two proximal phalanges of the toes lie within the plantar web.

The muscles that flex and adduct the great toe show the same arrangement and same variations in both, and in the extensor muscles of that digit only the tibialis anticus is different, making an approach to the human form in the Gorilla. Of 7 Gorillas, only the tendon was divided in 5; the division extended deeply into the muscle in 2: in the Chimpanzee, on the other hand, resembling the lower Primates, the muscle and tendon were divided in 16, the tendon only in 3. This, again, is a point in which the Gorilla shows an adaptation to plantigrade progression.

When the digital limb of the foot is examined, the Chimpanzee shows the greater number of primitive features. The contrahentes muscles, either as fibrous bands or as fibro-muscular slips, are always more evident in the Chimpanzee than in the Gorilla. The interosseous muscles in the foot of the Chimpanzee are arranged as in all the lower Primates, the third digit receiving the insertion of the 2nd and 3rd dorsal interossei muscles; but in 3 out of 7 Gorillas the second digit, as is the case in Man, received the insertion of the 1st and 2nd dorsal interossei muscles. In this feature also the Gorilla shows an approach to an adaptation for plantigrade

progression. In both, the muscles of the fifth toe show a marked tendency to become vestigial—a condition which occurs in Man, and which Mr. Herbert Spencer believes to be due to the wearing of boots; but the retrograde changes are most marked in the Gorilla. In 4 out of 11 Chimpanzees this digit received a tendon from the *extensor brevis digitorum*, a tendon found in only 1 Gorilla out of 8. The flexor brevis of this digit was absent in 3 Chimpanzees and fibrous in 11; it was absent in 3 Gorillas, fibrous in 6, and muscular in 3. The flexor accessorius is equally variable in both; it was found in the feet in 6 out of 10 Gorillas and in 6 out of 11 Chimpanzees. The origin of the flexor brevis digitorum shows much variation in both animals, but the tendency for a complete transference of the origin of this muscle from the tendon of the long flexor of the foot to the tuberosity of the heel is most marked in the Chimpanzee, a character in which it more resembles Man than its congener.

The better adaptation of the lower extremity of the Chimpanzee for a climbing-organ is seen in the extensive insertion of the semitendinosus, gracilis, sartorius, and biceps to the fascia of the leg, in the occasional slip from the *adductor magnus* to the inner head of the *gastrocnemius*, and in the separation of the *scansorius*. The scansorius is a segmention from the anterior border of the deepest gluteal sheet, for the more complete flexion of the hip-joint. It existed as a separate muscle in 6 out of 11 Chimpanzees and in only 2 out of 8 Gorillas. The lower extremity is nearly equal in length (sometimes longer) to the upper extremity; in the Gorilla it is always shorter; but the proportion of the anterior and posterior limbs varies considerably.

Some well-marked features, related to their methods of locomotion, distinguish the upper extremity of the Chimpanzee from the Gorilla. The arm of the Chimpanzee is that of the brachiators, anthropoids like the Orang and Gibbon, which use the arms as one of the main organs of locomotion. The arm of the Gorilla resembles more in its proportions that of the lower Apes. Both the Chimpanzee and Gorilla agree in showing many retrograde changes in the thumb. In neither is it a grasping-organ. The flexor longus pollicis is vestigial in both; in Gorillas it was represented by a tendinous thread springing from the deep flexor of the index digit in 2; in the remaining 10 it was completely absent or represented by a piece of tendon in the thumb only. In 25 Chimpanzees it was present as a thread in 15, and in the remaining 10 it was completely absent or merely the terminal part of the tendon was present. The retrograde change has made furthest progress in the Gorilla. The short muscles that flex the thumb have the same arrangement in both, except that the *opponens pollicis* is better marked in the Gorilla.

There are differences in the extensor muscles of the thumb. The tendon of the extensor ossis metacarpi is much more completely divided into a carpal and a metacarpal part in the Chimpanzee; and while this tendon sent a slip to the proximal phalanx of the thumb, as it always does in Man, in 4 out of 9 Gorillas,

such a slip occurred in only 1 out of over 20 Chimpanzees. On the other hand, the *extensor longus pollicis* of the Chimpanzee frequently sends a slip to the proximal phalanx, an occurrence not met with in Gorillas. The thumb in the Chimpanzee is on the whole the more robust, but in the arrangement of the extensor muscles the Gorilla approaches most nearly to Man. In proportion to the length of the upper limb, the thumb of the Chimpanzee is slightly the longer.

There are certain well-marked points of distinction between the palmar and digital parts of the hand of the African Anthropoids. The hand of the Chimpanzee is long and narrow, a hook to cling by; the hand of the Gorilla is shorter and broader. The metacarpal and phalangeal parts of the Chimpanzee hand make up over 25 per cent. of the length of the upper extremity; it seldom exceeds 22 per cent. of the Gorilla's arm and is frequently less. The hand of the Chimpanzee is adapted for brachiation, the hand of the Gorilla is not. The contrahentes muscles to the 4th and 5th digits are very seldom absent in the Chimpanzee; they are seldom present in the hand of the Gorilla. The tendon of the flexor profundus digitorum to the index digit commonly sends a slip to the tendon of the third, a rare occurrence in the Chimpanzee.

The arrangement of muscles on the back of the hand, as in the case of those of the flexor aspect and of the thumb, is most primitive in the Chimpanzee. In both apes the superficial extensor muscle to the fifth finger is small or absent; the extensor indicis, a muscle of the deep layer of extensors, was present in all the Chimpanzees examined, but only in 7 out of 8 Gorillas; the deep extensor of the 3rd digit was present in none of the Gorillas, but in 5 of 12 Chimpanzees; the corresponding tendon to the 4th digit was present in 1 of 8 Gorillas and in 4 of 12 Chimpanzees. The deep extensor of the fifth digit was present with equal frequency.

A curious transmigration in the origin of the forearm muscles, resembling the change that has occurred to a greater extent in Man, is seen at the elbow of the Chimpanzee. The *pronator radii teres* has in the Chimpanzee an origin from the coronoid process of the ulna in 9 animals out of 11, in only 3 out of 8 Gorillas; an origin of the *flexor corpi radialis* from the radius is more common amongst Chimpanzees; the flexor sublimis digitorum had a coronoid origin in 10 out of 12 Chimpanzees and in only 1 out of 8 in the larger ape.

A consideration of muscles which have become more or less vestigial in Anthropoids shows how closely the Chimpanzee and Gorilla are related to each other, and at the same time how they differ. The following list will show this at a glance:—

	Gorilla.		Chimpanzee.	
	Present.	Absent.	Present.	Absent.
Palmaris longus	4	7	9	3
Plantaris	0	12	25	17
Peroneus quinti digiti.	Equally small or absent in both.			
Pyramidalis	„	„	„	
Psoas parvus	„	„	„ (absent 40 p.c.).	

The *latissimo-condyloideus*, a muscle which has been reduced to a mere fibrous vestige in Man, is much diminished in size in both Gorilla and Chimpanzee, but it is larger and more primitive in its attachments in the Chimpanzee than in the Gorilla. The humerus is proportionally long in the Gorilla (40 per cent. or more of the limb). The arm of the Chimpanzee, considering all its characters, approaches the conditions found in the brachiating Apes and shows features adapted for climbing not shown by that of the Gorilla.

A distinctive feature of the Gorilla, and one adaptative to plantigrade progression, is the great development of the anterior-superior part of the ilium. The breadth of the iliac fossa, measured from the posterior-superior to the anterior-superior iliac spine is never less than 17 cm. in the adult Gorilla and never more than 13 cm. in the Chimpanzee. The result of this development is that the posterior part of the external oblique muscle of the abdomen is inserted to it; the tensor vagina femoris arises from it; the iliac crest acts as a fulcrum for these muscles to balance the body on its lateral aspects.

The bones and muscles of the Chimpanzee thorax resemble the arrangement found in lower Primates more closely than those of the Gorilla.

One of my pupils, Mr. Tredgold [1], has shown that the average costal development of the Chimpanzees is 13·20 ribs, for Gorillas 12·86; there are commonly 13 pairs in both, but 12 pairs occur in the Gorillas occasionally and 14 pairs not unfrequently in the Chimpanzees. The lower limbs of the Gorilla show a tendency to be fixed to a vertebra higher up than in the Chimpanzee [2]. The lumbar curve is more pronounced in the Gorilla [3]. Further, in the more extensive attachment of the pectoral muscles to the chest-wall, and in the absence of a hiatus between the clavicular and sternal parts of the pectoralis major, the Chimpanzee recalls the arrangement in the lower Primates more than is the case in the Gorilla. The secondary attachment of the pectoralis minor to the coracoid process, a constant insertion in Man, is the rule in Gorillas and the exception in Chimpanzees; it occurred in 8 out of 9 Gorillas and 7 out of 18 Chimpanzees. That point also indicates adaptation in the arm of the Chimpanzee to brachiation.

There is a very well-marked difference between the Gorilla and Chimpanzee in the attachment of the extensor muscles of the neck. The difference is seen in the Chimpanzee's more extensive cervical origin or insertion of the *trapezius*, *rhomboideus*, *splenius colli*, *levator anguli scapulæ*, and *omo-trachelien* muscles; they have also a more extensive attachment to the dorsal vertebræ below. The wide cervical attachment, which was the rule for these muscles in the Chimpanzee, was the exception in the Gorilla. These attachments are adaptive to the greater mobility of the head of the Chimpanzee, a feature in which it much more resembles Man than the Gorilla.

[1] Journ. of Anat. & Physiology, vol. xxi. p. 288.
[2] A. M. Paterson. Trans. Roy. Society, Dublin, 1893, ser. 2, vol. v. pt. iii.
[3] D. T. Cunningham. Cunningham Memoirs, Roy. Irish Acad. 1892, no. vii.

It will be thus seen that there is scarcely a feature in any muscle or any bone in the body of the Chimpanzee or Gorilla that can be said to be distinctive, and yet, when their characters are summed up, on an average, there are very striking differences between the body of the one and the body of the other.

7. *The External Ear of the Gorilla and Chimpanzee.*

The external ear of Man and the Anthropoid Apes, as well as that of some South-American monkeys, is in a retrograde phase of development. Retrogression has proceeded furthest in the ear of the Orang-utan, to a less degree in the ears of Man and the Gorilla, and least in that of the Chimpanzee. "Johanna" has what may be described as the typical Chimpanzee ear, a form not known to occur amongst Gorillas. It measures 85 mm. from the top of the helix to the lower border of the lobule, and 50 mm. from the base of the tragus to the posterior border of the helix. The height of the Gorilla ear seldom exceeds 60 mm. and its breadth is commonly about 40 mm. The ear of the Chimpanzee stands out from the side of the head at an angle, like the wind-sail from the port-hole of a steamer; the ear of the Gorilla is appressed to the side of the head. Du Chaillu describes the ear of *A. kooloo-kamba* as very large; the ear of *A. aubryi*, supposed to be of this species, was much smaller than that of "Johanna"; while the ear of "Mafuka" resembled in size that of the Gorilla. The small, Gorilla type of ear is seen occasionally in the Chimpanzee. The Chimpanzee type of ear is quite a common human form. The folding of the posterior border of the ear, which must be regarded as evidence of a retrograde development, has proceeded to a further extent in the Gorilla than the Chimpanzee.

The degree to which the posterior border of the Helix is folded in Gorillas and Chimpanzees.

	Number.	Not folded.	2 mm. fold or less.	4 mm. fold or less.	Average.
Gorillas	19	2	15	5	1·30
Chimpanzees ..	22	9	12	1	·60

The lobule of the ear is more developed in the Gorilla. "Johanna" possesses a very large lobule, measuring about 12 mm. in depth.

The development of a Lobule in Gorillas and Chimpanzees.

	Total number.	Lobule less than 10 mm. deep.	Less than 15 mm. deep.	More than 15 mm. deep.	Average.
Gorillas	25	4	16	5	10·4 mm.
Chimpanzees.	14	9	4	1	3·4 mm.

The average development of the lobule of the human ear is nearly 15 mm. Its meaning is unknown.

Darwin's point appears more frequently in the Gorilla than in the Chimpanzee. It appears in 9 per cent. Chimpanzees and 26 per cent. Gorillas, the last figure corresponding to its appearance in Man—taking an average of various races. The development of the antehelix in the Gorilla approaches that of Man more nearly than the Chimpanzee. The muscles of the ear are more rudimentary in the Gorilla than in the Chimpanzee. Almost in every point the ear of the Gorilla is the more human of the two. The external ear is certainly an aid in distinguishing between the Chimpanzee and the Gorilla.

8. *The Circulatory and Digestive Systems of the Gorilla and Chimpanzee.*

Our knowledge of these systems in the two African anthropoids is founded on a too limited amount of material to allow of any definite statement being made as to the points on which they differ. On the whole, they appear to resemble each other very closely. The only feature that appears to demarcate them is seen in the liver. The right lobe of the Gorilla liver shows always a deep fissure, separating off a right lateral lobe, a fissure which occurs vary rarely in the Chimpanzee and only occasionally in the Orang. The liver of the Gorilla, in its division, is the most primitive form found in the Anthropoids and most nearly resembles that of the lower Catarrhini. On the other hand, especially in its bulbous glans penis, the genital system of the Gorilla is the more human. Laryngeal sacs occur both in the Gorilla and Chimpanzee, and it is rather strange that "Johanna" has never been observed to manifest its presence.

9. *Hairs and Pigment as distinctive Features of the Gorilla and Chimpanzee.*

Neither the colour nor arrangement of hair, nor the degree to which the skin is pigmented assist much in the differentiation of the adult female Chimpanzee and Gorilla. In *Anthropopithecus niger* the pigment appears much later than in the other Chimpanzees, and circum-oral and supra-orbital parts of the face appear never to become deeply pigmented. The skin of the Gorilla, especially the face, ears, palms, soles, and dorsal aspects of the trunk and limbs, are deeply pigmented at birth. The adults of *A. calvus* and *A. kooloo-kamba* show an equally intense deposit of pigment; so does the Central-African variety, but it is unlikely they are so deeply pigmented at birth. The scalp of *A. kooloo-kamba*, taking Johanna as an example, seems almost as thinly supplied with hair as *A. calvus*. The arrangement of hair is the same in all.

10. *Features of the Face and Skull which are characteristic of the Chimpanzee.*

Next to the teeth, the most characteristic features of the Gorilla are to be found in the structure of its nose. The Gorilla retains

the long nasal bones of the lower Catarrhini; in all the other Anthropoids and in Man they have undergone marked retrogression, especially in the Orang. The nasal bones, as can be seen in the living Chimpanzee, extend downwards to the level of the lower border of the orbit and are never over 25 mm. long; in the Gorilla they extend much lower down and are never less than 40 mm. in length. The nasal bones of the Gorilla show a sharp median ridge, evident in the living animal. This ridge appears at adolescence and sometimes disappears in very old animals. A trace of this ridge is seen on the nasal bones of the Central-African Chimpanzee. The nasal bones unite before birth in the Gorilla, at or after birth in the Chimpanzee. At their upper end the nasal bones of the Gorilla always project within the interfrontal suture, sometimes to a slight degree, frequently to a very considerable extent, and at their lower ends unite into a spine in over 60 per cent. of skulls. On the other hand, the nasal bones of the Chimpanzee seldom project within the interfrontal suture and only to a slight extent, the examples occurring mostly in Central-African Chimpanzees, and show an inferior spine in only 15 per cent. of skulls, and these were mostly from Central Africa. The inter-orbital breadth and the shape of the bridge of the nose have frequently been used as characters of differentiation. They both depend on age, and to some extent on sex. All through the life of a Chimpanzee the bridge of the nose keeps changing in conformation, owing to the continual growth of the lachrymo-ethmoidal air-sinus; the convex bridge of the young adult becomes converted into the flat or depressed bridge of the old adult. The inter-orbital breadth is practically the same for Gorillas and Chimpanzees, being greater in males than females, but the bridge of the nose in the Gorilla never becomes flattened and depressed like that of the Chimpanzee.

In her wide, smooth, rounded alar nasal folds, Johanna, and all the Chimpanzees ascribed to the variety of which she is an example, shows a marked Gorilline feature. *A. niger* never possesses these folds so markedly, although they do increase in size with age; but in the Gorilla they extend almost to the margin of the lip, the middle part of which shows a widely grooved philtrum. In Johanna a distinct transverse groove marks the upper lip from the nose, and such a groove occurs always in Chimpanzees. The middle and inferior turbinate bones of the Chimpanzee are more convoluted than in the Gorilla, and the nasal duct less inflated.

In development, the palatine processes of the palate-bone of the Gorilla frequently fail to meet, giving rise to a form of cleft palate; they always, when they unite, leave an open angle between them: the corresponding processes in the Chimpanzee are always well developed and unite so as to leave the bony palate with a transverse posterior border. The nasal spines of the premaxilla are commonly present in the Gorilla (17 out of 28) and seldom in the Chimpanzee (5 out of 43). The nostrils are widest in the Gorilla. The anterior opening of the nasal cavity in the adult Chimpanzee

measures on an average 25 mm. high and 25 mm. broad; in the female Gorilla 29 mm. high and 31 mm. broad; 34 mm. high and 38 mm. broad in the adult male Gorilla. The orbits vary according to age, sex, and the individual, but they measure, almost without exception, most in the transverse diameter in the Chimpanzee, in the vertical in the Gorilla, a feature dependent on teeth development.

Certain features in the foramina for the exit of nerves in the facial part of the skull separate the Gorilla and Chimpanzee. The infra-orbital foramen in the Gorilla is divided into two or more compartments by a vertical bar, that in the Chimpanzee by a horizontal bar. This difference depends on the fact that the infra-orbital nerve in the Gorilla sinks down within the maxilla from the margin of the orbit; in the Chimpanzee it passes horizontally inwards from the maxillary-malar suture. The foramina for the nasal nerves are always to be seen in the nasal bones of the Gorilla, never in those of the Chimpanzee; in the Chimpanzee these foramina occur in, or at the side of, the upper part of the premaxilla. Malar foramina occur only occasionally in the Gorilla; they are always present in the Chimpanzee. The inferior palatine foramen of the Chimpanzee is divided by a process of bone—a division not seen in the Gorilla.

The supra-orbital ridges in Johanna project from the frontal bone to a depth of 22 mm., and are separated by a glabellar notch. This notch is very seldom seen in the female and never in the male Gorilla. It rarely occurs in the male Chimpanzee and is variable in the female, but does not appear to be confined to any particular race. The supra-orbital ridges keep on growing through life: in 5 young adult Chimpanzees their average depth was 14 mm., in 4 old adults 18 mm.; at corresponding periods of the same sex of the Gorilla they measure 20 and 25 mm. In this feature Johanna resembles the Gorilla. These ridges begin to form before the milk-dentition is completed, and the part they play in the animal economy is to strengthen the facial portion of the skull to give a firm dental support.

The skull of the Chimpanzee is the more brachycephalic. The average length of 10 skulls of Gorillas, excluding from the measurements the prominence due to the frontal air-sinuses and the external occipital protuberance, was 118 mm., the corresponding measurement in 10 skulls of Chimpanzees 103·6; the breadth of skull, from one parietal eminence to another, was in the first 94 mm., in the second 89 mm. The breadth of the skull in Gorillas is 80 per cent. of the length, in Chimpanzees 86 per cent. But the measurements overlap, and many of the measurements of the female Gorilla correspond to those of the female Chimpanzee.

The temporal ridges in Johanna are about 25 mm. apart on the crown of the head, a Chimpanzee character. In only 1 out of 5 adult female Gorillas had these ridges not fused into a median crest, and in that particular case the cranial capacity was uncommonly great. In it the temporal ridges were 20 mm. apart.

In 9 adult female Chimpanzees, on the other hand, in only one had the temporal ridges united to form a slight crest: the average distance between them is 22 mm. These ridges in the male Gorilla reach the sagittal suture as the canine teeth cut and fuse into a ridge, which continues to grow all through life. In the male Chimpanzee they only occasionally unite to form a ridge. The development of the temporal ridges, the height to which they reach on the roof of the skull, depends on the dentition. The condition in the adult female Chimpanzee corresponds to the stage of development found in a male Gorilla cutting its second molar tooth.

The lower jaw in the female Gorilla, almost without exception, exceeds in every dimension that of the female Chimpanzee.

11. *Summary.*

The Gorilla may be distinguished in life from the Chimpanzee by its sullen, untamable, ferocious nature; its long nasal bones descending far below the level of the infra-orbital margin; its great alar nasal folds running to the margin of the upper lip; its great peculiar molar, premolar, and canine teeth; its broad, short, thick webbed hands and feet; its long heel and the great length of its upper arm with the smaller development of the forearm.

EXPLANATION OF PLATE XX.

Anthropopithecus troglodytes kooloo-kamba. Taken from the specimen named "Johanna," living in the collection of Messrs. Barnum and Bailey.

2. Further Note on Specific Differences in the Anthropoid Apes. By W. L. H. Duckworth, M.A., Fellow of Jesus College, Cambridge.

[Received March 4, 1899.]

1. After reading a note on this subject to this Society in December 1898, I learned that in the Zoological Museum at Jena is an Ape, the determination of whose species has given rise to some discussion: the point in dispute being, whether it should be described as a Gorilla or a Chimpanzee. Through the kindness of Professor Haeckel I have been enabled to examine the specimen and have arrived at the following conclusion—that, although labelled "Junger weiblicher Gorilla,"[1] neither the stuffed skin nor the skeleton afford any evidence to justify the term Gorilla; and the facts that hardly a suture remains unclosed in the skull, that every epiphysis has long been fused with its diaphysis in the limb-bones, and that the teeth are much worn down, indicate that this was an *aged*, and not a *young* female. The average transverse diameter of the crowns of the molar teeth is 9·7 mm. (*cf.* the ape "A" at Cambridge, where the average is 10·4; and an undoubted female Gorilla with 14 mm.); and the mounted skeleton measures

[1] The label runs:—"*Troglodytes gorilla* (Cuv.). Junger weiblicher Gorilla, von einem Urunga Neger, 1885, in der Kolonie Gaboon erlegt."

only 1010 mm. in height (less than 3 ft. 4 in.). On renewed careful examination of the skeleton and of the skin, including observations on hair-colour, ear-dimensions, characters of the extremities and face, I could find no reason for regarding it as other than an old female Chimpanzee, but one considerably smaller than our Cambridge specimen "A" (also an aged female).

2. The foregoing instance is one in which a Chimpanzee is incorrectly described as a Gorilla. The converse, whereby a Gorilla is described as a Chimpanzee, may be noticed in the paper by Professors Kükenthal and Ziehen of Jena (in the 'Jenaische Zeitschrift für Naturwissenschaft,' Band xxix. 1894), entitled: "Untersuchungen über die Grosshirnfurchen der Primaten." On mentioning *Gorilla engena*, the authors state that they themselves had no opportunity of making observations on cerebral hemispheres of this species. They draw up, however, from the works of others, a list of twenty characteristic features of the fissures of the cerebral hemispheres in this species. They proceed to *Troglodytes niger*, of which they describe six hemispheres, with which they combine descriptions of two hemispheres of *Troglodytes savagii*! The latter specimens are in the Museum of the Royal College of Surgeons, and are the cerebral hemispheres of a Gorilla that died in this Society's Gardens in 1887. More interesting than the omission of the authors to recognize the identity of *Gorilla engena* with *Troglodytes savagii* is the fact that out of the ten particulars in which the hemispheres of *T. savagii* are stated to differ from those of *T. niger*, in three only does such divergence from *T. niger* imply agreement with features previously described by the authors as characteristic of *Gorilla engena*, while in three cases there is divergence from these characteristic features of *Gorilla engena*, and in the remaining four instances no comparisons can be made. But further, from the examination of these hemispheres of *T. niger* and *savagii*, the authors proceed to draw up a list of characters specially typical of the hemisphere of the Chimpanzee, and seventeen of these affect features that appeared in the list for *Gorilla engena*. Of these seventeen characters, thirteen actually present similarities in conformation between the hemispheres of *Gorilla engena* and of the Chimpanzee (i. e. *T. niger* and *T. savagii* of Profs. Kükenthal and Ziehen), while only four indicate differences of conformation. If we may accept the data, no better proof could be adduced of the practical identity of Gorilla and Chimpanzee in respect of cerebral convolutions.

3. The study of cerebral hemispheres of Gorilla and Chimpanzee respectively (in my possession) shows in strong relief the diversity of conformation that may be met with in the brains of the former. Consequently the value to be attached to the arrangement of the cerebral convolutions as a criterion of species is insignificant, and herein the conclusion arrived at in the preceding paragraph is corroborated. I should prefer, however, to postpone the further consideration of this part of the subject until I have been able to consult the communication so lately made to the Zoological Society on the brain of the Gorilla.

[P.S.—Two points respecting the geographical distribution of the Gorilla appear to me to call for notice here. Last year (1898) the occurrence of a Gorilla near Brazzaville on the Congo was recorded, and, in fact, the specimen was brought to England. Secondly, in the same year was published Captain Burrows's book, entitled 'The Land of the Pigmies,' which contains a photograph of an Ape described as a Gorilla, which was shot at Stanley Falls. If we regard this Ape as a genuine Gorilla, it follows that the eastward range of that animal is much more extensive than it is commonly supposed to be; but unfortunately the evidence of the photograph alone does not support that specific title, showing as it does that the specimen was possessed of distinct Chimpanzee features. Without further investigation, therefore, no final conclusion on this point can be arrived at.]

3. On the Myology of the Edentata. By Bertram C. A. Windle, D.Sc., M.D., M.A., F.R.S., Professor of Anatomy in Mason University College, Birmingham, and F. G. Parsons, F.R.C.S., F.Z.S., F.L.S., Lecturer on Comparative Anatomy at St. Thomas's Hospital and Hunterian Professor in the Royal College of Surgeons, England.

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Part I.—Muscles of the Head, Neck, and Fore Limb.

It has been for some time our intention to gather together the very scattered literature on the subject of Edentate myology, and to check it by a series of dissections of such animals as we could collect. We are greatly indebted to this Society, to Professor Stewart of the Royal College of Surgeons, and to Professor Howes of the Royal College of Science for giving us opportunities of dissecting specimens in their stores. We submit that the comparatively large number of records which we have been able to bring together as the result of our own dissections and a study of the literature has given us an opportunity of indicating which muscles are constant and which are liable to variation. For this reason we are glad to be able to point out that we have several records of most of the existing genera of Edentates. There are many points on which further information is desirable, and we feel that the paper is far from complete; still, as the investigation has been lengthy and arduous, it has seemed best to publish this first part and to defer, as in the case of the Carnivora, the generalizations which we intend to offer, until the remainder of the muscles are dealt with, in a second part of this paper. As in former papers, small numerals refer to the list of animals at the commencement of the paper and Roman figures to the bibliography at its end. Those animals in the list against which no author's name is placed have been dissected by ourselves.

List of Animals.

Family Bradypodidæ.

1. *Bradypus tridactylus.*
2. „ „ (Humphry, IV.)
3. „ „ (Macalister, XIV.)
4. „ „ (Meckel, XI.)
5. „ „ (Mackintosh, XVI.)
6. „ „ (Cuvier & Laurillard, XVII.)
7. „ „
8. *Cholœpus didactylus.*
9. „ „ (Humphry, IV.)
10. „ „ (Mackintosh, XIII.)

Family Myrmecophagidæ.

11. *Myrmecophaga jubata* [1].
12. „ „ (Pouchet, II.)
13. „ „ (Macalister, I.)
14. *Tamandua tetradactyla.*
15. „ „ (Rapp, III.)
16. „ „ (Cuvier & Laurillard, XVII.)
17. *Cyclothurus didactylus.* (Humphry, IV.)
18. „ „ (Macalister, I.)
19. „ „ (Meckel, V.)
20. „ „ (Galton, VI.)
21. „ „ (Cuvier & Laurillard, XVII.)

Family Dasypodidæ.

22. *Dasypus villosus.*
23. „ *sexcinctus.* (Galton, X.)
24. „ „ (Cuvier & Laurillard, XVII.)
25. *Tatusia peba.* (Macalister, VII.)
26. „ sp. inc. (Meckel, XI.)
27. *Chlamydophorus truncatus.* (Macalister, XI.)
28. „ „ (Hyrtl, XII.)

Family Manidæ.

29. *Manis macrura.*
30. „ „
31. „ sp. inc.
32. „ *aurita.* (Humphry, IV.)
33. „ *tricuspis.* (Macalister, I.)
34. „ *javanica.* (Macalister, VII.)

Family Orycteropodidæ.

35. *Orycteropus capensis.* (Galton, VIII.)
36. „ „ (Humphry, IX.)
37. „ „ (Cuvier & Laurillard, XVII.)

[1] R.C.S. Eng. Collection.

Panniculus.—Bradypodidæ. The three records which we have of this muscle in *Bradypus* all agree in stating that the dorsal portion is very feebly marked. The ventral part or abdomino-humeralis passes backwards as far as the outer surface of the thigh, whilst anteriorly it covers in the axilla, and is attached to the pectoral ridge deep to the pectoral muscle. We have succeeded in satisfying ourselves that the sterno-facialis and sphincter colli are both absent in this family.

Myrmecophagidæ. In *Cyclothurus* the abdomino-humeralis resembles that of the *Bradypodidæ*; it is well marked on the outer side of the thigh and extends as far as the knee. Humphry (17) describes a femoral attachment between the ectogluteus and vastus externus. In *Tamandua* (14) the dorso-humeralis is better developed than the abdomino-humeralis.

Dasypodidæ. In this family the panniculus is remarkably specialized, being divided into a number of slips which are inserted into the carapace. In *Tatusia peba* (25), Macalister describes seven parts, viz.: (*a*) abdomino-femoral, from the mid-line of the abdomen to the anterior edge of the femur; (*b*) abdomino-tergal, from the anterior part of the mid-line of the abdomen to the deep surface of the dorsal shield; (*c*) ischio-tergal, from the tuber ischii to the deep surface of the pelvic shield; (*d*) pectoro-brachial, from the mid-line of the pectoral region to the fascia on the inner border of the arm; (*e*) dorso-pectoral, from the integument over the clavicular pectoral to the anterior angle of the dorsal shield; (*f*) from the angle of the mouth and the skin over the side of the jaw to the lateral border of the dorsal shield as far as the elbow; (*g*) a similar and longer slip connected with the posterior trapezius. In *Dasypus villosus* (22) the most important bundle, which is probably platysmal in its nature, passes from the lower part of the zygoma to the cephalic border of the first part of the dorsal carapace and thence backwards as far as the fourth segment. Another band passes from the skull above the orbit to the head-shield. In *Dasypus sexcinctus* (24), Cuvier and Laurillard figure these zygomatic and occipital bundles, the former being, as in *villosus*, much the larger of the two. The acromio-basilar of Galton (23) is well-marked and passes from the skull anterior and lateral to the occipital slip to the acromion process at its junction with the spine. It lies wholly superficial to the trapezius, and is clearly the same as Cuvier's portion cervicale du trapèze.

In *Chlamydophorus* (27) there is no connection between the panniculus and the sphæroma; the abdomino-humeralis is represented by a thin slip from the external aspect of the thigh to the surface of the abdomen. Some fibres, which appear to be quite separate from those of the trapezius, pass from over the scapula to the cephalic shield, and these may probably be homologous with the acromio-basilar of *Dasypus*. In the *Manidæ* the panniculus more closely resembles the more common mammalian arrangement. The abdomino-humeralis is very thick and dorsally inseparable from the dorso-humeralis, the two covering the outer side and

front of the thigh and buttocks. Some fibres also find their way to the inner side of the thigh and there blend with the gracilis. Anteriorly the more ventral fibres, to which alone the name of abdomino-humeralis should be applied, pass deep to the pectoarls and are inserted partly into the ribs and partly into the pectoral ridge of the humerus. The more dorsal part of the panniculer sheet, or dorso-humeralis, is partly inserted with the abdomino-humeralis, deep to the pectorals, and partly runs to the fascia of the dorsal surface of the arm and the posterior border of the outer end of the spine of the scapula. In our specimens of *Manis* the platysma is quite rudimentary, though it appears to be well developed in *Manis javanica* (34) (Macalister). In the *Orycteropodidæ* (35, 36) there seems to be a remarkably well-developed panniculus. We have not, unfortunately, had the opportunity ourselves of dissecting the Aardvark, but the descriptions of the platysma in this animal which are at our disposal are quite clear, and seem to show that it there reaches a development superior to anything which we have as yet met with in our researches into mammalian musculature. It is described as passing from the zygomatic region over the neck and shoulder and arm to the radial side of the forearm. Humphry (36) and Cuvier and Laurillard (37) both figure this extensive platysma, and both also figure a very well-marked sphincter colli or sterno-facialis running backwards to the hinder end of the sternum, superficial to the pectorals. Galton (35) describes a muscle running from the orbicularis oris to the hinder end of the thorax, where it is attached to the mid-line of the sternum: this, there can be little doubt, is the sterno-facialis (*cf.* "Lectures on the Muscles of Mammals," Journ. of Anat. & Phys. vol. xxxii. p. 430). The same author states that part of this muscle passes under the jaw and round the neck, a fasciculus which quite clearly corresponds to the sphincter colli of other mammals. The abdomino-humeral part of the panniculus in this animal is also well developed (37).

Facial Muscles.—There is little of special interest to note with regard to the facial muscles of the Edentates, and there is so much variety in the terminology employed by different writers that a satisfactory generalization is most difficult. All the animals seem to possess the orbiculares palpebrarum et oris, levator labii superioris, zygomaticus, depressor labii inferioris, and retractor naris, as well as anterior, superior, and posterior auricular muscles, the last-mentioned being usually the best developed of the three. The muscles of the face in *Myrmecophaga* have been described in great detail by Owen (Trans. Zool. Soc. vol. iv.).

In *Bradypus* the zygomaticus is well marked, whilst the most remarkable feature in the *Dasypodidæ* and *Manidæ* is the great development of the retractor naris, which rises from the zygoma and passes directly forwards to the snout and is evidently a valuable adjunct in rooting and grubbing.

Masseter.—In *Bradypus* (1) the muscle is bilaminar, but the two layers are not very easily separable. The superficial rises

from the anterior inferior border and from the inferior angle of the malar, and is inserted into the lower border of the mandible from the angle to midway between the angle and the symphysis. The deep layer comes from the lower part of the posterior border of the malar and is inserted into the outer surface of the mandibular ramus. In his elaborate account of the muscles of the face in *Myrmecophaga*, Owen does not mention any bilamination of the masseter. In *Dasypus* (22) the muscle is distinctly bilaminar. The same condition obtains also in *Chlamydophorus* (27, 28), where, according to Hyrtl, it is intersected by tendons. In *Manis* (29, 30) the masseter is thin and unilaminar and arises from a fibrous zygoma. We have no records of its condition in *Orycteropus*.

Temporal, *Buccinator*, and *Pterygoidei* show no points of special interest.

Digastric.—In the *Bradypodidæ* this muscle reaches from the paramastoid process to the middle third of the body of the mandible. In 1, 5, and 6 it is described as possessing a slight tendinous intersection opposite the hyoid bone, from the inner side of which intersection is given off a fibrous arcade similar to that met with amongst the *Sciuridæ*. In 3 no tendinous intersection was noticed. *Cholœpus* (9) has a tendinous intersection, though none was noticed by Macalister in his specimen. We have no records of the digastric in any of the *Myrmecophagidæ*. Among the *Dasypodidæ* the digastric is described as monogastric by Macalister, who states that it is attached below the mandible in *Dasypus* and *Tatusia*. In our specimen of *Dasypus*, and in a second which we specially examined with reference to this point, the muscle was absent, but it is figured by Cuvier and Laurillard (24) as arising by tendon and inserted by fleshy fibres. In *Chlamydophorus*, Macalister found a very small digastric passing from the bulla tympani to the mandible, but Hyrtl found none in his specimen of the same animal. In the *Manidæ* the digastric is inserted into the lower jaw as far as halfway to the symphysis; it possesses no central tendon (29). In the *Orycteropodidæ* (36, 37) the muscle has the same arrangement.

Mylo-hyoid.—This muscle is always well marked in the Edentates, being especially large in *Myrmecophaga*, *Tamandua*, and *Manis*, in all of which animals the posterior fibres curve round the sterno-glossi and the part of the tongue into which these are inserted, forming a narrow tunnel or sheath in which they are enclosed.

Sterno-maxillaris, *Hyoid*, and *Thyroid.*—The first of these muscles is absent in the *Bradypodidæ*. In *Bradypus* (1, 5) the latter two are fused as far as the caudal edge of the larynx, at which point a slip is delaminated from the mesial and ventral part of the muscle and continued to the hyoid bone, the greater part of the muscle passing to the thyroid cartilage. In *Cholœpus* (10) the two muscles have practically the human attachments. In the *Myrmecophagidæ* the sterno-maxillaris is present as a superficial

delamination from the sterno-hyoid (*M. jubata*, Owen, XV.). In *Tamandua* and *Cyclothurus* it rises from the manubrium and is inserted into the mandible near the symphysis. In the *Dasypodidæ* the sterno-maxillaris is also present in *Dasypus* (22), *Tatusia* (25), and *Chlamydophorus* (27, 28). In the *Manidæ* no sterno-maxillaris was noticed nor is any recorded in *Orycteropus*. The only animal in which a tendinous intersection was noticed was *Tamandua* (14), in which the condition existed in the sterno-maxillaris.

Sterno-glossus.—This muscle has so far only been recorded in *Myrmecophaga*, *Tamandua*, and *Manis*. Whether it is present in *Cyclothurus* we are unable to state. It rises from the xiphi-sternum and the last one or two true ribs and passes forward at first deep to the sternum and costal cartilages, and is subsequently ensheathed, as has already been mentioned, in fibres derived from the mylo-hyoid, to be inserted into the tongue. In *Myrmecophaga* Owen points out that it is intersected in its thoracic portion by lineæ transversæ.

Styloid Muscles.—The stylo-hyoid, glossus, and pharygneus seem to be generally present, and of these the stylo-glossus appears to be always the best developed. The stylo-pharyngeus is usually small, and the stylo-hyoid is sometimes absent.

Omo-hyoid.—In no Edentate have we ever seen this muscle, nor is it specifically described by any author, though it is stated in one paper that Cuvier noted it in *Myrmecophaga*, a reference which we have been unable to trace.

Sterno-cleido-mastoid.—In the *Bradypodidæ*, *Bradypus* (1, 3, 4) is remarkable for having the two parts closely united, whilst in *Cholœpus* they are distinct. In *Bradypus* the single muscle rises from the manubrium and the fascia external to it and may (3) get a slight origin from the rudimentary clavicle. It is inserted into the paramastoid and paroccipital region of the skull and has the spinal accessory nerve on its deep surface. In *Cholœpus* both sterno- and cleido-mastoids are present, the latter coming from the middle third of the clavicle, and the spinal accessory nerve passes between them. The cleido-mastoid muscle when it is present is, as in most mammals, inserted deep to the sterno-mastoid. In the *Myrmecophagidæ*, *Myrmecophaga* and *Tamandua* have only a sterno-mastoid, but *Cyclothurus*, in which the clavicle is well developed, has both sterno- and cleido-mastoids (17, 21). In one specimen of this animal (19) there are described distinct sterno-mastoid, cleido-occipital, and cleido-mastoid, the latter lying deep to the cleido-occipital. It is to be regretted that the relation of the spinal accessory nerve to these three muscles is not recorded. In the *Dasypodidæ*, *Dasypus* (22, 23, 24), *Tatusia* (25, 26), and *Chlamydophorus* (27) have separate sterno- and cleido-mastoids. In the last-mentioned animal, Hyrtl (28) mentions that the sterno-mastoids of opposite sides are fused in the neck. In *Manis* (29) the cleido-mastoid is absent. In *Orycteropus* (35, 36, 37) both sterno- and cleido-mastoids are

present, and the latter arises from the inner ½ or ⅓ of the clavicle.

Omo-trachelian.—This muscle is not a constant feature in Edentate myology. When present, it arises, as is usually the case amongst mammals, from the transverse process of the atlas, and is inserted into the acromion process. In the *Bradypodidæ* it was present in *Bradypus* (1, 3), being inserted in the latter specimen into the upper angle of the scapula. In another specimen (5) its existence is not mentioned, nor has it been noticed in *Cholœpus*. In the *Myrmecophagidæ* the muscle was absent in *Myrmecophaga* (13), but present and well marked in *Tamandua* (16) and *Cyclothurus* (18, 19). In the *Dasypodidæ* the muscle was absent in two specimens of *Dasypus* (22, 24) and no mention is made of its presence in a third (23); Macalister, however, records its existence in a specimen. In the *Manidæ* the muscle is well marked, but shifts its anterior attachment from the atlas to the mastoid region of the skull (29, 30, 31, 32).

Scaleni.—In no Edentate have we seen or met with any record of a scalene muscle lying on the ventral aspect of the subclavian vessels, so that it may be fairly definitely laid down that the scalenus ventralis is a muscle totally wanting in this order. The scalenus longus is attached to a very small number of ribs, another characteristic feature of Edentate myology. The following table gives a list of the attachments of longus and brevis in several specimens:—

	Longus.	Brevis.
Bradypus (1)	6, 7, 8, 9 C. V. & rib i.	6, 7, 8, 9 C. V. & rib i.
„ (4)	„ „	„ „
Cholœpus (10).....	2, 3, 4, 5, 6 C. V. & ribs i., ii.	
Tamandua (14)	3, 4, 5, 6 C. V. & rib i.	4, 5, 6, 7 C. V. & rib i.
Cyclothurus (17, 21) ...	4, 5, 6, 7 C. V. & rib i.	
Dasypus (22)	ribs iii., iv., v.	ribs ii., iii., iv.
Tatusia (25)	ribs i., ii., iii.	ribs i., ii.
Chlamydophorus (27)...	2, 3, 4, 5, 6 C. V. & rib ii.	2, 3, 4, 5, 6 C. V. & rib i.
„ (28)...	„ „	„ „
Manis (29)	2, 3, 4, C. V. & ribs ii., iii., iv.	4, 5, C. V. & rib i.

Rectus thoracis lateralis.—This muscle is, so far as we know, characteristic of the Edentates, as we have neither met with it nor any description of it among other mammals, in the course of our researches. It continues the direction of the scalenus longus caudalwards, being attached anteriorly to the first rib or pair of ribs and posteriorly to some of the hinder ribs. As a rule, the muscle is external to the rectus ventralis, but when the two overlap, as they did in our specimen of *Dasypus* (22), the rectus ventralis is the more superficial of the two, a fact which shows that the rectus thoracis lateralis cannot be regarded as a displaced supra-costalis. Indeed, the fact that it is found in *Cholœpus* (10) co-existing with the supra-costalis is alone sufficient to prove this. Macalister considers that this muscle is a lateral displace-

ment of a portion of the rectus ventralis. We have, however, very carefully examined the question and have come to the conclusion, from the facts that (i.) it so often continues the direction of the scaleni and (ii.) is occasionally connected to them by direct fibres, that the muscle should be looked upon as a caudad extension of scalenus longus and that its presence is correlated with the fact, already insisted upon, that the last-named muscle has a very limited attachment in the costal region. In the *Bradypodidæ* the muscle was noticed in five specimens of *Bradypus* (1, 3, 4, 5, 6); it was attached in all to the first rib anteriorly, but its posterior connections were various. In *Cholœpus* (10) it passed from the first and second ribs to the eighth and ninth. Amongst the *Myrmecophagidæ*, we have no record of its occurrence in *Myrmecophaga* itself, but in *Tamandua* (14, 16) it is well marked and passes from the first to the seventh and eighth ribs; it was also present in four specimens of *Cyclothurus* (17, 19, 20, 21). In the *Dasypodidæ* the muscle, for some reason not apparent to us, shifts its anterior attachment nearer to the mid-ventral line. Thus in *Dasypus* (22), as we have already mentioned, it is attached deep to the rectus ventralis, whilst in *Tatusia* (25) its anterior attachment is to the manubrium sterni. In *Chlamydophorus* (27) the muscle is very slender and feeble and is attached to the first rib. In another specimen of the same animal (28) Hyrtl does not allude to the muscle. Amongst the *Manidæ* the muscle was found passing from the 1st to the 3rd, 4th, 5th, 6th, and 7th ribs in *Manis* (29). Its presence is not recorded in any of the descriptions of the *Orycteropodidæ*, nor do Cuvier and Laurillard figure it in their plates of the myology of this animal (37).

Recti capitis dorsales.—There does not seem to be any delamination, producing a r. c. d. medius, as is the case in so many mammals. We find only records of r. c. d. superficialis et profundus (r. c. posticus major and minor), as in Man.

Splenius capitis et colli.—These muscles are subject to a good deal of variation in the Edentata and especially amongst the *Bradypodidæ*. In *Bradypus*, a form possessing nine cervical vertebræ, we are not surprised to find the colli very large and the capitis either very small (1, 4, 6) or absent altogether (3). In one specimen (3) there were two splenii colli, the anterior arising from the spines of the 3rd, 4th, 5th, and 6th cervical vertebræ, while the posterior came from five spines behind these. In *Cholœpus* (10), a form in which the number of cervical vertebræ is liable to reduction, the splenius capitis was large and rose from all the cervical spines or the ligamentum nuchæ dorsal to them. The splenius colli was absent. Amongst the *Myrmecophagidæ* there was no splenius colli in *Tamandua* (14) or *Cyclothurus* (21). In another specimen of the first-named animal (16) it went to the atlas only. Amongst the *Dasypodidæ* there was no splenius colli in *Dasypus* (22, 24), *Tatusia* (25), or *Chlamydophorus* (27). In *Manis* (29) there is also no splenius colli, nor have we any record of the muscle in *Orycteropus*. We may sum up the description of

these muscles amongst the Edentates by saying that the splenius colli is usually absent throughout the Order with the exception of *Bradypus*, in which animal the splenius capitis is feeble or wanting.

Trapezius.—In *Bradypus* (1, 2, 3, 5, 6) this muscle fails to reach the occiput, a fact which seems to be correlated with the lengthening of the neck due to the two extra cervical vertebræ. The origin is from the ligamentum nuchæ and the anterior 4th, 5th, and 6th spines. The anterior cervical fibres are continuous with the clavicular deltoid to form a cephalo-humeralis; the posterior cervical and thoracic fibres are separated from the former by a fibrous interval and are inserted into the spine of the scapula and acromion process. In *Cholœpus* the anterior part rises from the occiput and ligamentum nuchæ, and is inserted into the lower border of the scapular spine. The posterior fibres can with difficulty be separated from these and are inserted into the whole length of the spine. In the *Myrmecophagidæ* the trapezius forms a continuous sheet. In *Myrmecophaga* (13), *Tamandua* (14, 16), and two specimens of *Cyclothurus* (17, 21) there was no occipital origin, but in other specimens of the last-named animal (18, 19, 20) the muscle rose from the occipital curved line. In *Cyclothurus* the anterior fibres are inserted into the outer part of the clavicle, which is well developed in this animal. In *Myrmecophaga* (11) and *Tamandua* (14, 16) the anterior fibres form with the clavicular deltoid a well-developed cephalo-humeral, and as usual there is a fibrous intersection in the position of the clavicle. Amongst the *Dasypodidæ*, *Dasypus* (22) has the anterior fibres of the trapezius arising from the deep surface of the anterior part of the carapace, and these fibres form the cephalo-humeral. The posterior part of the muscle rises from the fourth cervical to the last thoracic spines and is inserted into the scapular spine. In *Chlamydophorus* the anterior part of the muscle is separated from the posterior by a cellular interval, the anterior fibres, as in *Dasypus*, arising from the head-shield. In *Tatusia* no mention is made of an origin from the carapace. In the *Manidæ* the cephalo-humeral is well marked and rises from the occiput (29, 31, 32, 33, 34). The remainder of the muscle forms one mass and is inserted into the spine of the scapula and its acromion process. In *Orycteropus* (35, 36, 37) the origin is from the occiput, ligamentum nuchæ, and anterior nine or ten thoracic spines, the insertion is into the spine and acromion process of the scapula, but there is apparently no clavicular bundle or cephalo-humeral muscle.

Latissimus dorsi.—This muscle has the ordinary origin from the posterior half of the thoracic spines, the lumbar fascia, and three or four posterior ribs, and is inserted, as usual in mammals, into the humerus below its neck. In the *Dasypodidæ* it is remarkable for rising from more ribs than usual, often from the third or fourth to the last. These costal origins blend with the deep part of the insertion of the pectorals, and form a muscular floor to the axilla. We regard them as unusually well-developed achselbogen,

or portions of the pectoral mass. Regarding as we do this mass and the panniculus of the region as portions of the differentiated lateral sheet of muscle carried out by the limb-bud, we believe achselbogen to be a rudimentary condition represented in its fullest development by the presence of a muscular floor to the axilla, and that in both these conditions we have to do with a section of the sheet lying between the pectorals and the latissimus dorsi. This arrangement has been noticed in *Dasypus* (22, 23, 24), *Tatusia* (25, 26), and *Chlamydophorus* (27, 28). In the last-named animal Macalister describes a special bundle of fibres rising from the mammillary processes of the first two lumbar vertebræ and gaining insertion into the posterior inferior angle of the scapula. We can quite concur with his statement that this bundle is not found in any other Edentate.

Latissimo-olecranalis.—This muscle is always present in Edentates, and is singularly well developed in many of them. In the *Bradypodidæ* the muscle is not of great size; in *Bradypus* it is inserted into the internal supra-condylar ridge (1, 2, 4, 6), while in *Cholœpus* it is attached to the arch of the large supra-condylar foramen. In the *Myrmecophagidæ* the muscle is of fair size and (in the specimen O. 11 at the R. C. S.) attached to the inner side of the olecranon. Pouchet (II.) speaks of an "accessoire interne" arising from the infraspinous fossa in his specimen (12). This may be a displaced latissimo-olecranalis, though the condition is clearly abnormal, since it was neither found by Macalister nor by ourselves (11). In *Tamandua* (14) we found the muscle with its usual attachments; but Rapp (III.) found it rising from the scapula close to the teres major, a condition which nearly agrees with that described by Pouchet as the "accessoire interne." In *Cyclothurus* the muscle has a more extended insertion than in the other Ant-eaters; it is attached to the forearm from the olecranon process to the palmar fascia (17, 18, 19, 20). Humphry (IV.) says that from its insertion the palmaris longus takes origin, this being one of several instances of unusual continuity between muscles generally separate one from another in other Orders. In the *Dasypodidæ* the muscle is very large and often has further origins than that which it obtains from the latissimus dorsi. In *Dasypus* (22) we found it rising (*a*) from the main insertion of the latissimus dorsi, (*b*) from the dorsum scapulæ, and (*c*) from that part of the latissimus dorsi muscle which arises from the thoracic vertebræ. The muscle covered the dorsal and internal aspects of the arm and was folded round the triceps in such a way as to render that muscle invisible until the latissimo-olecranalis was removed. The insertion was into the olecranon and upper half of the subcutaneous margin of the ulna. This is the maximum development of the muscle so far met with by us in any mammal. Galton does not mention any independent origin from the scapula in this animal (23), but otherwise his description agrees with our own. Cuvier and Laurillard (24) figure the same extensive insertion. In *Tatusia* the muscle is very large, and in one specimen (25) obtains an extra

origin from the teres major. In *Chlamydophorus* (27) it is also large and is inserted into the internal condyle, internal lateral ligament, olecranon, and fascia of the forearm. In the *Manidæ* the muscle is not quite so well developed as in the Armadillos; in this class it is inserted into the olecranon and fascia of the forearm (29, 30, 31, 32, 33). In *Orycteropus* (35) the muscle rises from the latissimus dorsi and apparently gets additional slips from the scapula and teres major; in part it joins the long head of the triceps.

Rhomboidei.—We have found it convenient for the purposes of mammalian myology to describe the rhomboid sheet in two parts, viz. rhomboideus capitis et colli and rhomboideus thoracis. In the *Bradypodidæ* the rule holds good which we have already found to apply to other neck-muscles. In correlation with its additional cervical vertebræ, *Bradypus* (1, 3, 4, 5) has no occipital origin to the rhomboid, whilst in *Cholœpus* this origin is well marked. In *Bradypus* there is no division between the rhomboidei colli et thoracis, but in *Cholœpus* (8) the r. thoracis, which is inserted into the vertebral border of the scapula opposite the root of the spine, is, at its origin, deep to the rhomboideus capitis et colli. In the *Myrmecophagidæ* the muscle forms a single undivided sheet without any occipital origin in *Myrmecophaga* (13), *Tamandua* (14, 16), or *Cyclothurus* (18, 19, 20). In the *Dasypodidæ* an occipital origin is always present and the rhomboideus thoracis is usually separate from the rhomboideus capitis et colli. The rhomboideus capitis often forms a separate slip and is called by Galton (VI.) the occipito-scapular. In the *Manidæ* the occipital origin is also always present (29, 31, 33, 34). In the *Orycteropidæ* the occipital origin is present but ill-developed (35, 36).

Rhomboideus profundus (*Levator scapulæ minor*).—This muscle, which rises from the transverse process of the atlas and is inserted into the base of the spine of the scapula, seems only to be distinct in *Orycteropus* (35, 36, 37). Indications of it may be found in other animals, but in them it is usually more or less blended with adjacent muscles, such as the rhomboideus capitis et colli, omo-trachelian, or serratus ventralis colli (neck portion of serratus magnus).

Serratus ventralis colli et thoracis (*Serratus magnus*).—The following origins of this muscle are given by different observers:—

	Cerv. Tr. Procs.	Ribs.
Bradypus (1)	absent.	1–7
„ (2)	6–9	1–2
„ (3)	6–9	1–8
„ (4)	9	1–7
„ (5)	7–9	1–7
„ (6)	9	1–7
Cholœpus (10)	5–7	1–8
Myrmecophaga (13)	2–7	1–8
Tamandua (14)	1–7	1–7

	Cerv. Tr. Procs.	Ribs.
Cyclothurus (17)	2–7	1–8
„ (18)	5–7	1–7
„ (20)	5–7	1–7
„ (21)	5–7	1–7
Dasypus (22)	hinder C. V.	1–8 or 9
„ (24)	5–7	1–7
Manis (29)	1–7	1–7
„ (30)	1–7	1–7
„ (32)	2–7	–
„ (33)	2–7	1–6
Orycteropus (35)	2–7	1–8
„ (36)	2–7	1–8
„ (37)	2–7	1–8

From the foregoing it will be seen that the neck portion of the muscle (the levator anguli scapulæ of human myology) is either absent or feebly developed in the *Bradypodidæ*. In *Tamandua* (14) and two specimens of *Manis* (29, 30) it is described as arising from the atlas, but past experience makes us think that in these cases the rhomboideus profundus is incorporated with the serratus ventralis colli. In some cases, e. g. *Cyclothurus*, the cervical, anterior and posterior thoracic origins may remain distinct as far as their insertion, and the muscle may then consist of three portions, as it more or less does in Man. In other cases, e. g. *Dasypus* (22), the cervical and thoracic portions may form two separate sheets, while in many instances the whole muscle forms one continuous plane. It may be added that on the whole the muscle is one of great strength, exceeding in this respect the condition met with in most of the mammals examined by us, also that the scapular insertion often takes the form of two strong bundles attached to a triangular portion of bone at the caudal and cephalic ends of the scapula respectively, the part between, though continuous with these two bundles, being comparatively thin.

Pectorales.—The pectoral mass in Edentates, as, indeed, generally amongst the Mammalia, is exceedingly hard to classify, for the greater the amount of available material, the more difficult does the generalization become. We feel that the only way to do justice to the subject would be to repeat the various descriptions *in extenso*; but as this is hardly possible, we shall content ourselves with making what generalization we can. We believe that a typical pectoral has superficial and deep manubrial and superficial and deep gladiolar planes, that there may be a clavicular portion and an abdominal sheet or pectoralis quartus arising from the linea alba, that one or more bundles may rise from the anterior ribs deep to the gladiolar fibres, and that these may be described as a pectoralis minor. In *Bradypus* we have six descriptions, no two of which agree. Macalister and Mackintosh failed to find any abdominal portion or anything representing a pectoralis minor.

In our specimens (1, 7) we found a feeble pectoralis minor rising from the second costal cartilage and passing to the fascia over the shoulder; while the abdominal pectoral (pectoralis quartus) was present and closely blended with the abdomino-humeral part of the panniculus. Cuvier and Laurillard (6) show in their figure an absence of pectoralis quartus, thus agreeing with Macalister and Mackintosh, but they represent a fairly well-marked pectoralis minor.

In *Cholœpus* a special bundle corresponding in origin to the superficial gladiolar fibres was inserted into the inner border of the flexor surface of the forearm. In *Myrmecophaga* (13) the superficial and deep manubrial fibres were fused and the superficial and deep gladiolar were distinct. There was no pectoralis minor. In *Tamandua* (14) and *Cyclothurus* (17, 18) the superficial manubrial and gladiolar fibres were fused. In *Dasypus* (22, 24) the same condition obtains, but the place of the deep gladiolar fibres is taken by the large part of the latissimus dorsi which passes across the floor of the axilla and is inserted with the pectorals. In *Tatusia* (25) clavicular, sternal, and abdominal bundles are present, and the same description applies to *Chlamydophorus* (27). In *Manis* (29, 30, 32) the superficial manubrial bundle is well marked, and, although narrow at its origin, spreads out to be inserted from the lower end of the deltoid tubercle to the internal condyle. In one specimen (30) it is noted that these manubrial fibres are twisted upon themselves in such a way that those rising most deeply were most superficial at their insertion. In *Orycteropus*, Macalister (I.), Humphry (IX.), and Galton (VIII.) all agree that a pectoralis minor is present. The pectoralis quartus (37) is also well marked.

Subclavius.—This muscle in the Edentates varies a good deal and is of considerable interest. In the *Bradypodidæ* it is present and is inserted not only into the clavicle, but into the coracoid process and acromion. This was the case in six specimens of this animal (2, 3, 4, 5, 6, 7) and in two of *Cholœpus* (10 and a specimen of Galton's). In the *Myrmecophagidæ* the muscle is absent not only in *Myrmecophaga* (13) and *Tamandua* (14 and X. p. 528), which have only rudimentary clavicles, but also in *Cyclothurus* (17, 18, 20, 21), in which this bone is well developed. In the *Dasypodidæ* the muscle is always large and inserted chiefly into the acromion process and the fascia over the supraspinatus. This is true of *Dasypus* (22, 23), *Tatusia* (25), and *Chlamydophorus* (27, 28). In the *Manidæ* the muscle is wanting (29, 31, 32, 33, 34). In the *Orycteropodidæ* the subclavius is present (35, 36), but, as in most Edentates, is inserted more into the acromion and fascia over the supraspinatus than into the clavicle. This arrangement is clearly an approach to the sterno-scapularis muscle so constantly found amongst hystricomorphine rodents.

Deltoid.—The usual three parts of the deltoid are present in Edentates, and, as a rule, are inserted very close together into the deltoid ridge. Speaking generally, the usual mammalian rule is borne out, that clavicular fibres are inserted lowest and pass

superficially to the others, while the spinous fibres are inserted highest and pass deep to the other two bundles. In those animals in which the clavicle is absent or rudimentary, the clavicular part of the muscle is continuous with the ventral fibres of the trapezius to form a cephalo-humeral. Among the *Bradypodidæ*, *Bradypus* has the cephalo-humeral, acromial, and spinous parts closely blended and inserted into the middle of the humerus (1, 3, 4). In two specimens (4, 5) a slip was given to the short head of the biceps from the cephalo-humeral. In *Cholœpus* the insertion varied in two specimens—in one (10) the clavicular and acromial portions were both inserted into the radius, while in another (8) all three parts went to the deltoid tubercle. Among the *Myrmecophagidæ*, *Myrmecophaga* (11, 12, 13) and *Tamandua* (14, 16) have each a cephalo-humeral and all three parts are inserted into the middle of the humerus. In *Cyclothurus* (17, 18, 19, 21) the clavicular, spinous, and acromial parts are all inserted into the humerus together, the two latter being apparently closely fused. In the *Dasypodidæ* the clavicular slip rises from the clavicle in *Dasypus* (22, 23), *Tatusia* (25, 26), and *Chlamydophorus* (27, 28), and is always inserted into the deltoid tubercle on the humerus. The acromial and spinous parts may or may not be separate. In the *Manidæ* the cephalo-humeral is well marked, the spinous and acromial parts are more or less fused, and in several specimens (29, 32, 33, 34) a separate bundle was traced from the spine of the scapula to the triceps or supinator longus. Macalister expresses some doubt as to the nature of this slip; but we have been able to satisfy ourselves, by tracing the circumflex nerve into it, that it is a part of the deltoid. In the *Orycteropodidæ* the clavicular portion is inserted into the radius with the biceps, the other two parts passing to the deltoid ridge (35, 36, 37).

Supra- and Infraspinati.—In all cases the supra- is considerably larger than the infraspinatus. In *Dasypus* (22, 23) the latter muscle rises between the two scapular spines.

Teretes major et minor.—One of the great characteristics of all members of the Edentate Order, with the sole exception of the *Myrmecophagidæ*, is the great development of the teres major. In many of these animals there is a considerable ridge of bone marking off the origin of the teretes from that of the infraspinatus. Of this ridge, which is called the inferior scapular spine, we have already written in connection with *Dasypus*. The teres minor in most of the Order has been described as present. In some cases it is described as being fused with the infraspinatus or subscapularis, but from our own experience of the Order we can quite easily understand how two observers, in the instances in which the muscle is not well marked, might readily differ in their description of the same animal, so that we shall content ourselves by saying that this muscle is usually a distinct entity throughout the Edentata.

Subscapularis.—In the *Bradypodidæ* the bundle of fibres rising from the axillary border of the scapula and obtaining an insertion

below the lesser tuberosity of the humerus is specially marked off from the rest of the muscle. The name of subscapulo-humeral, which sufficiently indicates its nature, has been suggested for this slip (1, 2, 5, 10). In one specimen of *Bradypus* (2) the subscapularis was divided into three parts, the hindmost of which was the subscapulo-humeralis. In *Myrmecophaga* Macalister (I.) found the muscle intersected by ten tendinous planes, and the specimen now in the R.C.S. Museum (11) shows the same condition. We further found in this specimen that five separate nerves, all from the dorsal part of the brachial plexus, entered the muscle. Macalister states that there are two accessory slips to the muscle in this animal: (*a*) the subscapulo-humeralis, and (*b*) "a triangular slip from the fossa above the subscapular nerve." Pouchet (II.) found that the tendon of insertion split into upper and lower parts and between them was the short head of the biceps; it is, however, just possible that he may have mistaken the upper edge of the supraspinatus, which is very prominent in this animal, for part of the insertion of the subscapularis. In *Tamandua* (14) the muscle is also considerably broken up. In no other Edentate was any special feature of interest noted in connection with this muscle.

Coraco-brachialis.—An Edentate characteristic of considerable interest is the great frequency of occurrence of the coraco-brachialis longus throughout the Order. In the *Bradypodidæ*, *Bradypus* and *Cholœpus*, as is so often the case, differ in their myology. In the former the coraco-brachialis medius alone is present (1, 2, 3, 4, 5, 6), and in our own specimen (1) we were careful to notice that the musculo-cutaneous nerve passed above the muscle, *i. e.* between it and the bone. In *Cholœpus* (8, 10) the brevis and longus alone were present, though Galton (X.) in another specimen says that he found only a thin cord-like middle variety. In the *Myrmecophagidæ*, *Myrmecophaga* (11, 12) and *Tamandua* (14, 15, 16) have the longus only attached to the supracondylar arch, and given off from the short head of the biceps about the middle of the arm; whilst in the four specimens of *Cyclothurus* of which we have records (17, 18, 20, 21) no coraco-brachialis at all was present. In the *Dasypodidæ* the longus and brevis were present in two specimens of *Dasypus* (22, 23), but in another specimen described by Wood (Journ. of Anat. & Phys. i. p. 51), and in Cuvier and Laurillard's specimen (25), the longus only was found. In *Tatusia* the longus and brevis were present in one specimen (25), the longus only in another (26). In *Chlamydophorus* the muscle was totally absent in Hyrtl's specimen (28), whilst in Macalister's (27) the brevis was present. In the *Manidæ* the muscle was totally absent in five specimens (29, 30, 31, 32, 34), but in one (33) the longus occurred. In *Orycteropus* (35, 36, 37) the longus alone is present. From the above it will be seen that this muscle is very variable in its condition throughout the Order, not alone varying in different genera but in different specimens of the same animal.

Biceps.—Among the *Bradypodidæ*, *Bradypus* is remarkable for possessing a humeral head. This was noticed in five specimens (1, 2, 3, 4, 5), and is described under that name by all five observers individually. In all these cases the head was large, and in all the insertion of the muscle was much blended with that of the brachialis anticus. We must confess that we find it very difficult to give any general rule for determining when a slip coming from the anterior aspect of the humerus and more or less connected with both brachialis anticus and biceps should be regarded as a brachialis anticus internus and when a humeral head of the biceps. When the connection is only with one muscle, as is sometimes the case, the task is comparatively simple. We are not, in this instance, prepared to take a different line from the above-mentioned writers, and therefore, at least conditionally, adopt their terminology. In all the five animals above alluded to there was also a glenoid head, and one (2) in addition possessed a coracoid head, which went to the fascia on the inner side of the forearm. The combined gleno-humeral muscle may be inserted into the radius or the ulna or both. In *Cholœpus* (8, 10) only the glenoid head is present, and is inserted partly into the radius partly into the ulna. In one specimen (8) part of the muscle joined the acromial deltoid. In the *Myrmecophagidæ*, *Myrmecophaga* (11) has glenoid and coracoid heads, the latter rising from the position which would be occupied by the coracoid process were it present; the glenoid or long head divides below, the more superficial fibres being inserted into the radius with the short head, whilst the deeper group join the brachialis anticus to be inserted into the ulna. The description which we have of the other two specimens (12, 13) seems to agree fairly accurately with the above. *Tamandua* (14, 15, 16) resembles *Myrmecophaga*, though Rapp describes a humeral head in addition, which we believe, in this case, is a part of the brachialis anticus. In *Cyclothurus* (17, 18, 19, 20, 21) only the glenoid origin is present and inserted into the radius and ulna, usually with the brachialis anticus. In the *Dasypodidæ* two heads were present in four specimens (22, 23, 24, and an extra specimen) out of five recorded. In *Tatusia* (25, 26) and *Chlamydophorus* (27) only the long head is present. In the *Manidæ* the gleno-ulnar part of the muscle alone is present (29, 30, 31, 32, 33, 34). In *Orycteropus* (35, 36, 37) the long head appears to be the only part represented.

Brachialis anticus.—In the *Bradypodidæ* the outer part of the muscle alone is usually present, and does not in all cases reach as high as the surgical neck of the humerus. It may or may not join the biceps before its insertion, which is into the radius or ulna or both. In our specimen of *Bradypus* (1) there was also an inner head, which was almost continuous with the coraco-brachialis. In the *Myrmecophagidæ* the muscle is remarkable for its frequent fusion with the biceps. We can definitely state that in this family the generalized mammalian brachialis anticus rising from the back of the surgical neck of the humerus and winding round

the outer side of that bone is not present. In *Myrmecophaga* the humeral head of the biceps, already described, may with considerable probability be looked upon as a suppressed and modified brachialis anticus (11, 12, 13). In *Tamandua* (14, 15) the condition is practically the same. In *Cyclothurus* (17, 18, 19, 20) the muscle rises below the deltoid ridge. In the *Dasypodidæ* the external part of the muscle is present and rises from the neck of the humerus in the usual mammalian manner. This applies to *Dasypus* (22, 23), *Tatusia* (25), and *Chlamydophorus* (27). In the *Manidæ* the outer or long head was found, as in the last-mentioned family, in every case (29, 30, 31, 32, 33, 34). In only one case was the internal head found (29), and in that it rose from the front of the humerus below the deltoid ridge. In two cases (30, 31) this head was carefully looked for, but without success; it is, however, frequently so closely fused with the external head that, unless specially sought for, it is very easily overlooked. In *Orycteropus* (35, 36) the external head was present as usual, but the internal head was present, as a few fibres rising from below the deltoid ridge, in one specimen only (35).

Triceps and Anconeus.—In the *Bradypodidæ*, *Bradypus* (1, 2, 3, 4, 5) and *Cholœpus* (8, 10) have the usual three heads, and the inner of these tends to fuse with the anconeus. In the *Myrmecophagidæ* the muscle is often very specialized. Pouchet (II.) describes six heads, three superficial and three deep. The three superficial he calls: (*a*) "La longue," which is equivalent to our longus, though a few of its fibres rise from the dorsum scapulæ and remind us of the arrangement found in some of the Mustelidæ amongst the Carnivora (Proc. Zool. Soc. 1897, p. 394). This arrangement was also found in the R.C.S. specimen (11). (*b*) "L'accessoire interne," which we have already alluded to as a displaced latissimo-olecranalis. (*c*) "L'accessoire externe," which rises by tendon between the two parts of the deltoid and becomes fleshy as it descends. It was not present in the specimen which we examined from the R.C.S. The three deep heads of Pouchet are: (*d*) "Le vaste interne," (*e*) "Le vaste externe," and (*f*) "L'accessoire médian." The two former are simply the usual external and internal heads of the muscle, while the third consists of some fibres from the short head of the biceps to the triceps, which we did not find in the R.C.S. specimen. Macalister (13) points out that the internal head becomes tendinous and passes through a groove behind the internal condyle, through which it plays as through a pulley, its tendon then becoming continuous with one of the heads of the flexor of the digits. This remarkable arrangement, also met with in *Orycteropus*, must, as Macalister remarks, give great additional power to the latter muscle and is a further example of the unusual confluence of usually separate muscles in this Order. In *Tamandua* (14, 15) the long head is very large, rising from all that part of the dorsum scapulæ below the inferior spine which is not occupied by the teres major. In one case (15) an additional

scapular head is noted as rising from just below the glenoid cavity The fibres of the inner head have the same pulley-like arrangement as in *Myrmecophaga*, as shown by Cuvier and Laurillard's figure (16), and by Rapp's description of them as forming a humeral head for the flexor profundus digitorum (III.). Of the five specimens of *Cyclothurus* of which we have records, three had only one scapular head (17, 18, 21), whilst in two (19, 20) this was double. In one of the first-named group (21) a continuation of the muscle into the forearm, as in *Tamandua* and *Myrmecophaga*, was present. In all the *Myrmecophagidæ* the anconeus is large, and especially so in *Cyclothurus*. The *Dasypodidæ* resemble the last family in having, as a rule, two scapular heads, which may be called anterior and posterior. The anterior rises from the axillary border below the glenoid cavity, and the posterior from the dorsum scapulæ in the region of the lower spine. This applies to *Dasypus* (22), *Tatusia* (25), and *Chlamydophorus* (27, 28). In Galton's specimen of *Dasypus* (23) the long head was apparently single, while in one specimen of *Chlamydophorus* (27) there was a third scapular head from the inferior margin of the bone. In the *Manidæ* the scapular head is also usually double, this condition having been noticed in three cases (29, 31, 34); in two cases (32, 33) no division was seen. In *Orycteropus* multiple scapular heads seem to be the rule. In 36 there are three, viz. (*a*) glenoid, (*b*) from the posterior costa, (*c*) from the angle, passing to the triceps and the latissimo-olecranalis. In (35) only two were noticed, but one of them seems as if it would be more properly described as a scapular origin of the latissimo-olecranalis, and the same thing seems to have been present in (31). Macalister (VII.) notices that in a specimen which he dissected the lower fibres of the inner head play round the internal condyle and join the flexor profundus as in the *Myrmecophagidæ*. The anconeus presents no special features of interest in the *Manidæ* and *Orycteropodidæ*. In conclusion, we may point out that all the Edentata, with the exception of the *Bradypodidæ*, are remarkable for the great development and complexity of the extensor cubiti and for the presence of additional scapular origins.

Epitrochleo-olecranalis.—We can confirm Galton and Gruber's observations as to the constancy and remarkable development of this muscle throughout the Edentata.

Pronator radii teres rises from the internal condyle and seems to be always inserted into the lower third or half of the radius. This arrangement we find to be so constant that it may be fairly looked upon as an Edentate characteristic.

Flexor carpi radialis.—Unlike most mammals the Edentates show some variability in the insertion of this muscle, though its origin from the internal condyle is constant enough. In the *Bradypodidæ* it never seems to obtain its normal insertion into the second metacarpal bone. In four specimens of *Bradypus* (2, 3, 5, 6) it was inserted into the rudimentary trapezium. Mackintosh (5) found a small muscle, which he calls flexor carpi radialis profundus, rising from the ulna and running down to the deep

fascia of the wrist. In three specimens of *Cholœpus* (8, 9, 10) the muscle was inserted into the scaphoid. In the *Myrmecophagidæ* the insertion was into the second metacarpal in *Myrmecophaga* (11, 13), *Tamandua* (14), and *Cyclothurus* (17, 18), but in another specimen of *Myrmecophaga* it was into the third metacarpal. Among the *Dasypodidæ* the insertion was into the trapezium in *Dasypus* (22, 23), but in *Tatusia* (25) and *Chlamydophorus* (27) into the first metacarpal bone. In the *Manidæ* the insertion varies. In four specimens of *Manis* (29, 30, 31, 32) the muscle passed to the second metacarpal only, but in two others (32, 34) slips were given to the three radial metacarpals. In *Orycteropus* (35, 36) the insertion was into the second metacarpal, but a sesamoid bone was apparently developed in the tendon, a portion of which was attached to the styloid process of the radius. In 37 it was also inserted into the second metacarpal.

Palmaris longus.—In six specimens of *Bradypus* (1, 2, 3, 4, 5, 6) this muscle was present, rising from the internal condyle and gaining an insertion into the palmar fascia by one or more of the bony prominences about the palm. In three specimens of *Cholœpus* (8, 9, 10) the muscle was also present. In the *Myrmecophagidæ* it is difficult to determine what is palmaris longus and what flexor sublimis digitorum. A careful comparison of the descriptions given by Macalister (13) and Pouchet (12) with the College of Surgeons' specimen (11) makes us inclined to believe that in *Myrmecophaga* the palmaris longus is absent. In *Tamandua* (14, 16) the muscle extends from the internal condyle to the fibro-cartilaginous anterior annular ligament. In *Dasypus* (22, 23) some superficial fibres of the flexor sublimis passed to the annular ligament, representing, we think, a palmaris longus, but in another specimen (24) the muscle is absent. In *Manis* the muscle may extend from the condyle and olecranon process to the palmar fascia (29, 31, 33) or it may be fused with the flexor sublimis (30, 32, 34). In *Orycteropus* the muscle is either fused with the flexor sublimis (35, 36) or is absent (37).

Flexor sublimis digitorum.—In *Bradypus* this muscle is always absent (1, 2, 3, 4, 5, 6). In *Cholœpus* it is present and has two delicate tendons (8, 9, 10), which are more or less connected above with the palmaris longus. In *Myrmecophaga* (11, 12, 13) and *Tamandua* (14, 15, 16) it rises from the internal condyle as well as the olecranon process and some of the shaft of the ulna below it. It is inserted into the middle phalanx of the medius, splitting to enclose the flexor profundus tendon, but not showing the ring which is so evident in Rodents, Insectivores, and Carnivores. In *Dasypus* the muscle gives tendons to the index and medius (23, 24) or to the medius only (22). In the *Manidæ* the arrangement of this muscle is very inconstant and various writers seem to have confounded it with the palmaris longus. In the two specimens (29, 30) which we dissected the arrangement was quite different. In 32 there was a slip for the pollex from the fascia of the lower part of the forearm, condylar slips for the index and medius, while

the annularis and minimus were supplied by slips from the olecranon and the surface of the flexor profundus. We are, however, not sure whether some of these factors should not rather be referred to the palmaris longus. In 30 the flexor sublimis passed from the condyle to the medius only; before being perforated by the profundus in the theca it had the usual ring passing deep to that tendon. In (29) and (31) no flexor sublimis was seen. Of the other specimens, (34) had also a slip for each digit, whilst (33) resembled (29) and (31) in having no sublimis at all. In *Orycteropus* (35, 36, 37) there were in each case four tendons for the four digits.

Flexor carpi ulnaris.—As usual, this muscle rises from the internal condyle, olecranon, and margin of the ulna. The condylar and olecranal heads unite in the forearm to be inserted into the pisiform. In *Bradypus* (1, 3, 5) the tendon, instead of ending in the pisiform, was inserted into the base of the most ulnar of the three metacarpals. In *Cyclothurus* (13) the muscle is very large and important in function; the pisiform, a fact no doubt correlated with that just mentioned, is also very large.

Flexor profundus digitorum.—In the *Bradypodidæ*, *Bradypus* (1, 2, 3, 5) has radial, ulnar, and condylo-ulnar heads and divides into three tendons for the three digits. In our own specimen of *Cholœpus* (8), radial, ulnar, condylo-central, and condylo-ulnar heads were present, and this seems also to have been the condition in 9 and 10. The muscle ends in two strong tendons. In the *Myrmecophagidæ*, *Myrmecophaga* has a head continuous with the lower part of the triceps and already described in connection with that muscle. In addition to this it possesses radial, ulnar, and condylar heads. It is a very large muscle and has a variable insertion. In Pouchet's specimen (12) a slip was given to the pollex, but in that at the R.C.S. there were only three tendons, neither pollex nor minimus receiving one. In one specimen of *Tamandua* (15) a humeral head was present, but we failed to find it in our specimen (14). In this instance, however, the factors were much united, and we with difficulty identified radial, ulnar, condylo-ulnar, and condylo-central portions. In one specimen (15) the tendons passed to all five digits, whilst in the other (14) the pollex was not supplied with one. In *Cyclothurus* (17, 18, 19, 20, 21) we have no records as to which condylar heads are present, but the muscle only possesses two tendons, which pass to the second and third digits respectively. In *Dasypus* (22, 23, 24), *Tatusia* (25, 26), and *Chlamydophorus* (27) the muscle is very large, the ulnar portion being specially well developed. In all these animals a strong fibro-cartilaginous sesamoid is developed in the palmar part of the tendon before its division, beyond which slips are given off to all the five digits. In two specimens of *Manis* (30, 32) there were condylo-ulnar, radial, and ulnar heads present. In another (29) the condylo-centralis was present in addition. A palmar sesamoid is present as in the Armadillos, but not to such a marked extent. There may or may not be a small

tendon to the rudimentary pollex. *Orycteropus* (35, 37) has condylo-ulnar and central parts, also radial and ulnar. The common tendon, which possesses no sesamoid, gives off four tendons.

Lumbricales.—Amongst the *Bradypodidæ*, *Bradypus* (1, 2, 3) is devoid of any of these muscles, but *Cholœpus* (9) has two, one for each digit. In the *Myrmecophagidæ* two specimens of *Myrmecophaga* (11, 12) had four muscles, whilst another (13) had only two. *Tamandua* (14) had three, that for the index being absent, but in another specimen (16) there were six. In *Cyclothurus* two specimens (18, 20) had two lumbricales, whilst another (17) had none at all. *Dasypus* (22, 23, 24) possessed none at all. In *Chlamydophorus* Hyrtl (28) failed to find any; but in another specimen (27) seven slender fleshy bundles are described as rising from the sesamoid cartilage in the flexor tendon, which are inserted into each side of the middle phalanges of all the digits except the pollex. In *Manis* the number is very variable; there were three in (30), four in (32) and (34), and two in (33). In all the specimens of *Orycteropus* of which we have records (35, 36, 37) there were four.

Pronator quadratus.—Amongst the *Bradypodidæ* this muscle is very small, both in *Bradypus* (1, 2, 3, 5) and *Cholœpus* (8, 9, 10), occupying in the former only one-eighth to one-sixth of the forearm. The *Myrmecophagidæ*, viz. *Myrmecophaga* (12, 13), *Tamandua* (14), and *Cyclothurus* (17, 18, 20), have the muscle extending over the whole length of the interosseous space. In *Myrmecophaga* (12), Pouchet notices that the lower third of the muscle corresponds to the human pronator quadratus in being attached to the surfaces of the radius and ulna, whilst the upper two-thirds is attached only to the opposed margins of the bones. In the *Dasypodidæ* and *Manidæ* the muscle is usually absent, this being the case in *Dasypus* (22, 23), *Chlamydophorus* (28), and *Manis* (29, 30, 31, 32, 33, 34). In *Tatusia* (25, 26) it was extremely rudimentary, and in one specimen of *Chlamydophorus* (27) it was represented by a feeble fibrous cord. In *Orycteropus* (35) it occupied the whole length of the bones, as was the case in the *Myrmecophagidæ*, though Humphry describes it as being small.

Supinator longus.—This muscle is always present in the *Bradypodidæ* and is often double. Of four specimens of *Bradypus*, three (2, 4, 5) had the muscle delaminated into a superficial and a deep layer, both of which arose from the supracondylar ridge, the more superficial being inserted lower down than its deeper fellow. In the other three specimens (1, 3, 6) the muscle was single and rose from the lower half of the humerus. In the last of these (6) the supinator longus and pronator radii teres joined before their insertion. The bilaminar condition of the supinator longus was found in all three specimens of *Cholœpus* of which we have records (8, 9, 10). In 9 the superficial layer was inserted into the fascia over the wrist, the deep into the radius. In the other specimens (8, 10) both parts were attached to the radius. In the *Myrmeco-*

phagidæ the arrangement closely resembles that of the Sloths. Of three specimens of *Myrmecophaga* the muscle was bilaminar in two (12, 13), the superficial part going to the fascia and posterior annular ligament and the deep to the styloid process of the radius. In *Tamandua* (14, 16) and *Cyclothurus* (17, 18, 19, 20, 21) the same condition obtained. It is well figured by Cuvier and Laurillard (plate 237). In the *Dasypodidæ* the supinator longus is absent in *Dasypus* (22, 23, 24), *Tatusia* (25, 26), and *Chlamydophorus* (27, 28). In the *Manidæ* the muscle may be present (32, 33, 34) or absent (29, 30, 31). When it is present it is closely connected at its origin with the deltoid, so much so that by some observers the two muscles have been described as continuous. In *Orycteropus* the muscle is present (35, 36, 37) and rises from a considerable portion of the length of the humerus. It is inserted partly into the radius, partly into the fascia over the tendons.

Extensores carpi radiales longior et brevior.—In the Sloths there are usually two insertions, although the muscular belly is described as single. In three specimens of *Bradypus* (2, 3, 4) the muscle, described as single, ended in two tendons, which were inserted into the radial pair of the three metacarpals; but in our own specimen (i.) the longior was absent and the brevior passed from the external condyle to the middle of the shaft of the central (3rd) metacarpal bone. Mackintosh's specimen (5) appears to have presented an identical arrangement. In three specimens of *Cholœpus* (8, 9, 10), in spite of the presence of only two metacarpal bones, both tendons were present, and in our own (8) we noticed that the muscular bellies were separable and that the longior was the smaller of the two. The two tendons were in all three cases inserted into the radial of the two metacarpals. The *Myrmecophagidæ* are remarkable for the suppression of the extensor carpi radialis longior, but the brevior is unusually strong. In *Myrmecophaga* (11, 12, 13), *Tamandua* (14, 15), and *Cyclothurus* (17, 18, 20) only the brevior was present, but in another specimen of the latter animal (19) both muscles were found. In the *Dasypodidæ* both muscles seem to be usually present, though the two bellies are sometimes described as being fused. The *Manidæ* are remarkable for the absence of the longior, this condition being noticed in five specimens (29, 30, 31, 32, 33). In *M. javanica*, however, tendons are described as passing to the second and third metacarpals. In *Orycteropus* the longior seems to have been present in (35) and absent in (36).

Extensor communis digitorum.—This rises as usual from the external condyle and is inserted into a variable number of digits. In *Cholœpus* it always passes to the second and third, the only two which are present. In *Bradypus* it may go to all three digits (1, 5, 6), the two outer (3) or the two inner (4). In *Myrmecophaga* all the digits may be provided with tendons (12, 13) or only the third and fourth (11). In *Tamandua* (14, 15) slips go to the medius and annularis only. *Cyclothurus* (17, 18, 19, 20, 21) possesses only a tendon for the medius. *Dasypus* (22, 23, 24),

Tatusia (25, 26), and *Chlamydophorus* (27) have tendons for the index, medius, and annularis. In the *Manidæ* a strong tendon passes to the medius, and the annularis and minimus are provided with feeble slips (29, 30, 31, 32, 33, 34). In the *Orycteropodidæ* (35, 36, 37) all four digits are provided with tendons.

Extensor minimi digiti.—In the Sloths this muscle is often either replaced by or becomes an extensor brevis digitorum, which rises from the dorsum of the carpus and metacarpus and is inserted into one or more of the few digits. It existed under this condition in two specimens of *Bradypus* (2, 3) out of five examined, and in one specimen of *Cholœpus* (9) out of three. In the cases in which an extensor brevis was not present, it was replaced by a normal extensor minimi digiti, which obtained an insertion into the most ulnar digit. In *Myrmecophaga* (11, 12) the muscle in question only went to the fifth digit. In *Tamandua* (14) it was attached to the fourth and fifth digits, and in *Cyclothurus* (19, 20) to the rudiments of the same. *Dasypus* (22, 23) and *Chlamydophorus* (27) had this muscle attached to the fourth and fifth digits, and *Tatusia* to the fifth only. In the *Manidæ* (29, 30, 32, 33) the muscle was present, but in our specimen it was inserted into the fifth metacarpal bone instead of into the phalanges. As a double tendon from the extensor communis to minimus is described in (32), it is probable that the condition was the same as has just been mentioned. In *Orycteropus* the extensor minimi digiti is inserted into the minimus and annularis (35, 37) or into the minimus alone (36).

Extensor carpi ulnaris.—There is little variety about this muscle; it is always present and rises from the external condyle and dorsal border of the ulna and is inserted into the base of the most ulnar of the metacarpals present.

Extensor ossis metacarpi pollicis.—In the *Bradypodidæ* both *Bradypus* (1, 2, 3) and *Cholœpus* (8, 9, 10) have this muscle inserted into the trapezium, though in Mackintosh's specimen (5) the insertion is said to have been into the base of the inner metacarpal. In the *Myrmecophagidæ* the muscle appears to be always present, but in *Cyclothurus* (17, 18) it is said to rise from the external condyle. In the *Dasypodidæ* it is present and extends from the ulna to the first metacarpal. In the *Manidæ* it sometimes is inserted into the first metacarpal, sometimes into the trapezium. In *Orycteropus* (35, 36) it is inserted into the dorsum of the trapezium.

Extensor profundus digitorum.—In *Bradypus* (1, 2, 3, 4, 5, 6) an extensor indicis, which passes to the most radial of the three digits, is always present. In *Cholœpus* (8, 9, 10) the extensor profundus always gives a slip to the radial of the two digits and sometimes (9, 10) to the ulnar one also. In *Myrmecophaga* (11, 12, 13) there are slips from the deep extensor to the pollex and index. In *Tamandua* (14, 15) there is, in addition, a slip to the medius. In *Cyclothurus* (17, 18, 19, 20) there is always a tendon to the third digit (medius) and sometimes one to the rudimentary

index as well. In *Dasypus* (22, 23) there are tendons for the index and pollex, but in (24) for the index only.

In *Tatusia* there are tendons for the index and medius in (25) and for index only in (26). In *Chlamydophorus* (27) the tendon to the index gives a fascial slip to the pollex. In *Manis* (29, 32, 33) the extensor indicis alone is present, but in one case (30) there is a polliceal slip as well. *Orycteropus* has a well-developed extensor profundus, which in two cases (35, 36) went to the index, medius, and annularis, and in another (37) to the index and medius only. It is interesting to notice that whilst in some of these animals the origin is as usual from the dorsal surface of the ulna, in others it seems to have slipped down and the muscle rises from the dorsum of the carpus and closely corresponds to the extensor brevis digitorum pedis. This low origin was found in the following animals: *Bradypus* (1, 4, 5), *Cholœpus* (10), *Cyclothurus* (17), *Manis* (30, 33).

Palmaris brevis.—This muscle was well marked in *Bradypus* (1), *Tamandua* (14), and *Cyclothurus* (18). In *Tamandua* it was a peculiarly large muscle, filling the great boxing-glove like pad on the ulnar side of the hand. In *Myrmecophaga* it was very feeble, if, indeed, it was present at all, whilst we failed to find any trace of it in any other Edentate.

Supinator brevis.—In the *Bradypodidæ* this muscle covers the upper third of the radius. In two specimens of *Cholœpus* (8, 10) it was divided into two layers, between which lay the posterior interosseous nerve, but in another specimen of the same animal (9) this division was not noticed. In the *Myrmecophagidæ* the muscle is inserted into the lower part of the radius—*Myrmecophaga* (11, 12), *Tamandua* (14), and *Cyclothurus* (17, 18, 19, 20). Among the *Dasypodidæ* the muscle is small in *Dasypus* (22, 23), small or absent in *Tatusia* (25, 26) and *Chlamydophorus* (27, 28). In the *Manidæ*, on the other hand, it is inserted into nearly the whole length of the radius (29, 31, 32, 33, 34), and has a sesamoid bone developed in its origin. In *Orycteropus* (35, 36) the muscle only occupies the upper half of the radius.

Intrinsic Muscles of the Hand.—We find it extremely difficult, in reading the literature of the subject, to understand at what depth the various muscles were placed and to which digit precisely they were attached. As it has been always our desire to err less on the side of commission than of omission, we feel bound to omit much which did not appear clear to us, and must therefore confess that our account of these muscles in the Edentata is somewhat of the scantiest. In *Bradypus* (1) there was an adductor pollicis and also adductors of the index and annularis, which were superficial to the deep branch of the ulnar nerve. An interosseous muscle is present between each of the metacarpal bones. In *Cholœpus* (8) there is an adductor indicis, belonging to the first layer of deep muscles, which rose from the carpus and was inserted into the ulnar side of the base of the proximal phalanx of the index; there is also an interosseous muscle on each side of the index. In the

specimen of *Myrmecophaga* which we examined (11) there was a well-marked flexor brevis digitorum manûs, which rose from the anterior annular ligament and was inserted into the middle phalanges of the annularis and minimus. The same muscle with the same attachments was evidently present in Pouchet's specimen (12). An adductor pollicis was met with in this specimen, arising from the base of the second metacarpal, and was also present in (11) and (13). In all three specimens an abductor minimi digiti, arising from the pisiform, was also present. The dorsal interossei were arranged as in Man. We were unable to examine the palmar interossei in our specimen, but in that described by Macalister (13) there were apparently two, belonging to the index and annularis respectively. In *Tamandua* (14) there were superficial adductors to the index, medius, and annularis, and a pair of flexores breves to each functional digit. There were also abductor and flexor brevis pollicis. In *Dasypus* (22) there is an abductor and flexor brevis pollicis, an abductor minimi digiti, and a transverse adductor indicis arising from the heads of the metacarpals of the annularis and minimus. Interossei are inserted into the radial side of the index and medius, and others are represented by fibrous bands. In *Manis* (30) there were superficial adductors from the bases of the palmar side of the metacarpals to the index and minimus. There were also four dorsal interossei arranged as in Man, but no palmar interossei were present. In *Orycteropus* (35, 36) there appear to have been superficial adductors for the index and minimus, an abductor minimi digiti, and paired flexores breves to all four digits.

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W. Purkiss lith. West, Newman imp

NEW SPECIES OF AFRICAN PHYTOPHAGOUS COLEOPTERA.

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4. Additions to the Knowledge of the Phytophagous Coleoptera of Africa.—Part II.[1] By Martin Jacoby, F.E.S.

[Received February 3, 1899.]

(Plate XXI.)

This paper forms the second part of that read before the Society last year. It deals with the species of the subfamilies *Halticinæ* and *Galerucinæ* of different parts of Africa, so far as I have been able to determine them at present. Most of the material was received from Mr. Guy Marshall, the indefatigable collector in Mashonaland, to whose labour we are indebted for so many novelties. In a future Supplement I hope to deal with the rest of the species received since.

Halticinæ.

Phygasia sulphuripennis, sp. n.

Entirely pale flavous, the antennæ robust, the thorax impunctate, with deep transverse sulcus; elytra extremely minutely and closely punctured.

Length 5 millim.

Head impunctate, frontal elevations and the clypeus broad, palpi robust; antennæ not extending to the middle of the elytra, flavous, the joints robust, the third and following ones of nearly equal length, the second, small and round; thorax about one-half broader than long, the sides rounded at the middle, the anterior angles blunt, the posterior ones distinct, the surface not perceptibly punctured, the basal sulcus deep, bounded at the sides by a perpendicular groove; elytra microscopically punctured, convex, their epipleuræ very broad and concave; metatarsus of the posterior

[1] For Part I. see P. Z. S. 1898, p. 212.

legs as long as the following two joints together; prosternum extremely narrow.

Hab. Salisbury, Mashonaland (*G. Marshall*).

This species is very closely allied to *P. pallida* Jac. and *P. gestroi* Jac., both African; it is, however, a more robust, larger and convex insect, the sides of the thorax are less rounded and the antennæ are shorter: from *P. lactea* Jac. the uniform flavous antennæ and much narrower thorax distinguish it. I received several specimens of it from Mr. Guy Marshall.

PHYGASIA MARGINATA, sp. n.

Flavous, the head and thorax impunctate; elytra chestnut-brown, finely and closely punctured, the lateral margins flavous, narrowly reflexed.

Length 4–5 millim.

Head flavous, impunctate, the frontal tubercles small and thick, carina broad and strongly raised, mandibles and palpi fulvous; antennæ rather robust, extending slightly beyond the middle of the elytra, flavous, all the joints thickened, the third and following ones of equal length, terminal joint more elongate; thorax twice as broad as long, the sides rounded and with a rather broad margin, the anterior angles obtuse, the posterior ones distinct, the base with a transverse sulcus bounded at the sides by a perpendicular groove, the surface entirely impunctate, flavous; scutellum flavous; elytra slightly wider at the base than the thorax, finely and closely punctured, with a narrow reflexed margin, the latter, the epipleuræ, and the apex more or less flavous, the rest of the surface dark brown; underside and legs flavous.

Hab. Cameroons (*Conrad*).

Three specimens, which I received from Dr. Kraatz, agree in every respect: the species may be known by the system of coloration, which differs from that of *P. marginicollis* Jac. (sub *Lactica*) in the flavous head, elytral margin, and similarly coloured underside; it is also of smaller size.

PHYGASIA LACTEA, sp. n.

Pale testaceous, the antennæ (the basal three joints excepted) black; thorax impunctate, the basal sulcus distinct; elytra extremely closely and finely punctured.

Length 5 millim.

Head impunctate, the eyes large, the frontal tubercles rather feebly raised, interrupted at the middle, the palpi very robust; antennæ black, the lower three joints flavous, all the joints rather robust, the third joint very slightly longer than the fourth; thorax transverse, more than twice as broad as long, the sides with a rather broad reflexed margin, rounded, the anterior angles oblique, posterior ones produced into a short tooth, the surface entirely impunctate, shining, the base with the usual sulcus deeply impressed and bounded at the sides by an equally deep longitudinal groove; elytra convex, not depressed below the base, distinctly

and very closely punctured; legs robust, the posterior metatarsus as long as the following two joints.

Hab. Cameroons (*Conrad*).

The single specimen in my collection, which Dr. Kraatz has kindly sent me, is of an entirely pale testaceous colour; it differs from its African allies of similar coloration in the black antennæ, the very transversely shaped thorax, and the distinct and close punctation of the elytra.

PHYGASIA MELANOCEPHALA, sp. n.

Testaceous, the head, antennæ, and the legs black; thorax sparingly and minutely punctured, the basal sulcation shallow; elytra very finely and closely punctured.

Length 4 millim.

Elongate and parallel; the head entirely impunctate, black, shining, the frontal elevations very broad, distinctly raised, the clypeus with an acute central ridge, penultimate joint of the palpi thickened; antennæ entirely black, the second one short, moniliform, the third and fourth joints equal, the terminal five joints slender and elongate: thorax twice as broad as long, the sides rounded, with a narrow margin, the disc with a few very minute punctures, testaceous, the base with a shallow transverse sulcus, bounded laterally by perpendicular grooves; elytra wider at the base than the thorax, very finely and closely punctured, their epipleuræ broad and continued below the middle: the underside and the base of the femora testaceous, the posterior femora but moderately thickened, the first joint of the posterior tarsi as long as the following joints together; claws appendiculate; prosternum very narrow; the anterior coxal cavities open.

Hab. Verulam, Natal (*G. Marshall*).

At once to be distinguished from every other species of the genus by the black head and legs.

PHYGASIA BRUNNEA, sp. n.

Pale fulvous, terminal joints of the antennæ and the legs piceous; head and thorax impunctate, the latter with deep basal sulcus; elytra finely and very closely punctured.

Length 3 millim.

Head impunctate, broad, the frontal tubercles small but distinct, the carina broad, labrum black; antennæ not extending to the middle of the elytra, robust, fulvous, the terminal joints more or less stained with fuscous, of subquadrate shape, the third joint the longest; thorax twice as broad as long, the sides strongly rounded at the middle, constricted at the base, anterior angles slightly thickened, the surface transversely convex, fulvous, shining, with a few microscopic punctures, the basal sulcus deep, bounded at the sides by a perpendicular groove; scutellum triangular; elytra wider at the base than the thorax, extremely finely and closely punctured: underside fulvous, finely clothed with white pubescence; the legs

darker, posterior femora strongly incrassate, their apical portion piceous, posterior tibiæ incrassate; anterior coxal cavities open.

Hab. Frere, Natal (*G. Marshall*).

A small species, of ovate and convex shape and with dark-coloured legs. *Lactica marginicollis* Jac., *L. africana* Jac., and *L. gabonensis* Jac. ought, I think, to find their places in *Phygasia* on account of the shape of the thorax; the last-named species is identical with *P. magna* Weise.

PHYLLOTRETA NATALENSIS, sp. n.

Flavous, the apical three joints of the antennæ, the breast and abdomen piceous; head and thorax finely punctured and coriaceous; elytra metallic dark greenish, finely geminate punctate-striate; posterior femora piceous.

Length 3 millim.

Elongate and subcylindrical; the head flavous, finely granulate and very minutely punctured, the frontal elevations entirely obsolete, clypeus raised and thickened, palpi slender; antennæ closely approached at the base, slender, and rather long, flavous, the apical three joints and the preceding one partly piceous or black, basal joint long, the second less than half its size, scarcely shorter than the third joint, the apical joints shorter and thicker; thorax about one-half broader than long, the lateral margins straight and distinctly narrowed in front, the anterior angles obliquely thickened, posterior margin sinuate at each side, the surface very closely and more strongly punctured than the head and finely granulate, flavous; scutellum extremely short, only just visible; elytra not wider at the base than the thorax, gradually widened towards the middle, greenish æneous, closely and finely punctured in double rows, distinct to the apex, the latter broadly rounded; legs rather robust, flavous, the posterior femora piceous, tibiæ with a minute spine, the posterior ones sulcate, the metatarsus of the posterior legs as long as the following joints together; anterior coxal cavities open; the breast and abdomen piceous.

Hab. Verulam, Natal (*G. Marshall*).

A nearly typical species and distinguished by the geminate punctate-striate elytra.

ŒDIONYCHIS RUGICOLLIS, sp. n. (Plate XXI. fig. 1.)

Flavous, the antennæ, part of the head, the breast and the legs blackish; thorax strongly rugose-punctate, with two piceous spots; elytra closely and strongly rugose-punctate, flavous, the suture and a broad longitudinal band on the disc, abbreviated posteriorly, dark green.

Length 6 millim.

Head strongly rugose, the vertex flavous, the lower portion black, frontal elevations strongly raised, fulvous; clypeus in shape of an acute triangular ridge, piceous; antennæ short and stout, only extending to the base of the thorax, the terminal seven joints transversely widened, black, the basal joints flavous, first

joint piceous above; thorax twice as broad as long, the sides nearly straight, obliquely narrowed, with a narrow reflexed and thickened margin, posterior margin oblique near the angles, rounded at the middle, the surface very strongly and irregularly rugose and deeply punctured, flavous, the sides with a transverse piceous spot; scutellum smooth, piceous; elytra convex, extremely closely and deeply punctured throughout, flavous, the suture narrowly dark green, a broad longitudinal band of the same colour extends from the middle of the base nearly to the apex and is rather more distantly placed from the suture than from the lateral margin; breast and legs more or less piceous, the abdomen and the posterior femora fulvous, the latter very strongly incrassate, their upper and basal portion piceous.

Hab. Niger-Benue Expedition.

I received a single specimen of this very distinct species from Herr Bang-Haas.

ŒDIONYCHIS SULCICOLLIS, sp. n.

Testaceous, the labrum and the intermediate joints of the antennæ black; head and thorax impunctate, the latter with a distinct transverse sulcus; elytra obscure fuscous, strongly and closely punctured.

Length 6 millim.

Head impunctate, the vertex swollen, frontal elevations broad, strongly raised as well as the clypeus, labrum black, palpi swollen; antennæ slender, the lower and the apical two joints testaceous, the third and the following joints equal, nearly twice the length of the second joint; thorax more than twice as broad as long, the sides strongly rounded, with a very broad flattened margin, the angles in shape of a small tooth, the surface with a deep transverse sulcus near the base, impunctate or with a few very fine punctures; elytra slightly widened towards the middle, with a rather broad reflexed margin, darker in colour than the thorax, strongly and closely punctured throughout, the interstices more or less wrinkled, especially so at the sides; below and the legs testaceous; posterior tibiæ with a strong spur, the metatarsus short, claw-joint strongly inflated.

Hab. Cameroons (*Conrad*).

This species is well distinguished by the deep thoracic sulcus and the strong elytral punctation. I have received a single specimen from Dr. Kraatz, another is contained in that gentleman's collection.

ŒDIONYCHIS AFRICANA Jac.

Of this species, a most variable one in regard to coloration, I have received specimens from Mashonaland and Natal, obtained by Mr. Guy Marshall. They vary much in size and have the elytral humeral spot sometimes connected with the black suture below the base, so as to include a flavous round spot of the ground-colour; the antennæ and legs are either entirely black or more or

less testaceous. In a specimen from Abyssinia contained in my collection the elytra have a sutural and discoidal black longitudinal band, the latter being interrupted anteriorly, leaving the shoulder-spot isolated; this specimen differs in no other way from the type. The species seems to have a wide distribution in Africa, which no doubt accounts for its many aberrations.

LONGITARSUS DIMIDIATICORNIS, sp. n.

Black, shining, the head piceous, the basal and apical joints of the antennæ fulvous; thorax very minutely punctured; elytra more strongly and closely punctate-striate, knees obscure fulvous.

Length 4 millim.

Of oblong, subcylindrical shape; the head piceous, impunctate, the frontal elevations feebly raised, the clypeus with a strongly raised central ridge; eyes very large; antennæ filiform, black, the lower three and the apical two joints fulvous, the third joint one-half longer than the second, thinner, the seventh and the following joints more elongate; thorax nearly twice as broad as long, the sides straight, with comparatively broad flattened margins, the anterior angles obliquely thickened, the surface very minutely but not very closely punctured; elytra slightly wider than the thorax, subcylindrical, the apex broadly rounded, the surface distinctly and closely punctate-striate; below and the legs black, the knees to a small extent fulvous, posterior femora strongly incrassate, their tibiæ greatly widened near the apex, and sulcate, the first joint of the posterior tarsi much longer than the following joints together; prosternum very narrow.

Hab. Cameroons (*Conrad*).

Of this species, distinguished by the colour of the antennæ, the broad thorax and its flattened margins, I received a single specimen from Dr. Kraatz.

APHTHONA DURBANENSIS, sp. n.

Subquadrate-ovate, black, the head fulvous; thorax flavous, extremely minutely punctured; elytra very finely and closely punctured, flavous, the sutural and lateral margins narrowly piceous; legs flavous, the posterior femora piceous above.

Length 3 millim.

Head impunctate, fulvous, the eyes with a few punctures or short grooves near the inner margins, frontal elevations narrowly oblique, distinct, labrum piceous; antennæ rather long and slender, flavous, the apical three or four joints blackish, second and third joints equal, the following two more elongate, of equal length, the apical joints longer; thorax subquadrate, one-half broader than long, the sides straight, the anterior angles oblique, posterior angles acute, the surface flavous, shining, with a few microscopical punctures; scutellum black; elytra wider at the base than the thorax, subcylindrical, very finely and closely punctured, the punctures somewhat regularly arranged, the sutural and lateral margins narrowly piceous, this colour not extending in either case

to the apex; the underside black, the legs and the basal portion of the posterior femora flavous; posterior tibiæ strongly widened and deeply channelled, their metatarsus as long as the following joints together.

Hab. Durban, Natal (*G. Marshall*).

APHTHONA BOHEMANI, sp. n.

Below piceous, the head, basal joints of the antennæ, the thorax, and the anterior legs reddish fulvous; elytra metallic dark blue, finely and closely punctured.

Length 3 millim.

Of subquadrate-ovate shape; the head impunctate, reddish fulvous, the frontal elevations not developed, clypeus strongly raised between the antennæ, labrum piceous; the antennæ slender, black, the lower four joints flavous, the second and third joints equal in length, the following scarcely longer; thorax subquadrate, one-half broader than long, the sides nearly straight, the anterior angles oblique, the surface entirely impunctate, reddish fulvous, shining; scutellum black; elytra wider at the base than the thorax, convex, the shoulders moderately prominent, the disc finely and closely punctured, metallic dark blue, the interstices finely wrinkled here and there; below and the posterior femora nearly black, the legs fulvous, the tarsi more or less fuscous, the posterior tibiæ more broadly sulcate, their metatarsus as long as the following joints together.

Hab. Frere, Natal, under bark of *Eucalyptus globulus* (*G. Marshall*).

A species distinguished by the metallic dark blue elytra and the fulvous head and thorax.

ORNEATES, gen. n.

Body ovate; antennæ with the third and following joints triangularly dilated; thorax transverse, with rounded posterior angles, the surface without sulcus; elytra irregularly punctured; posterior femora strongly thickened, the tibiæ longitudinally channelled, all armed with a small spine, the first joint of the posterior tarsi as long as the following two joints together, claws feebly appendiculate; the anterior coxal cavities open; prosternum extremely small.

This genus seems allied to *Trymnes* Weise (*Jamesonia* Jac.) on account of the rounded posterior angles of the thorax and the very narrow prosternum; but the entirely different structure of the antennæ, which differ in their dilated joints from most other genera of *Halticinæ*, will at once distinguish it.

ORNEATES NIGRITUS, sp. n.

Entirely black, shining, head nearly impunctate, thorax distinctly and rather closely punctured; elytra similarly but more closely punctured, the interstices finely wrinkled.

Length 2 lines.

Head broad, sparingly and finely punctured at the vertex, the frontal tubercles and the carina broad and short; antennæ extending to the middle of the elytra, black, the basal joint thickened, the second and third very short, equal, the following joints subquadrately widened, apical joint pointed; thorax nearly twice as broad as long, the sides rounded, the anterior angles thickened, the posterior ones obsoletely rounded, the posterior margin distinctly so, the surface not very closely but rather strongly punctured; scutellum broader than long; elytra very closely and evenly punctured, the punctures of the same size as those of the thorax, the interstices slightly wrinkled; underside and legs black.

Hab. Natal, obtained by sweeping (*G. Marshall*).

DECARIA ABDOMINALIS, sp. n.

Black, shining, abdomen flavous, the antennæ ten-jointed; thorax impunctate, elytra extremely finely punctured.

Var. Underside entirely black.

Length 4 millim.

Subelongate, black, very shining, the head impunctate, the frontal tubercles obsolete, transverse, clypeus with a strongly raised central ridge; antennæ short, ten-jointed, black, the fourth and the following joints transversely widened, not longer than broad, the terminal joint more elongate, second one very short; thorax transversely subquadrate, about one-half broader than long, the sides deflexed, the lateral margins nearly straight, the angles obtuse, the surface impunctate or with a few minute punctures; scutellum small; elytra much wider at the base than the thorax, parallel, subcylindrical, extremely minutely and not very closely punctured, black and shining, their epipleuræ continued below the middle; all the tibiæ mucronate, the posterior femora much thickened, the first tarsal joint as long as the following two joints together, claws appendiculate; abdomen flavous; prosternum very narrow; the anterior coxal cavities open.

Hab. Estcourt, Natal, on acacia-trees (*G. Marshall*).

I must refer this insect to Weise's genus *Decaria*, the only one, with the exception of *Psylliodes*, in which the antennæ have ten joints only. Weise speaks only of the posterior tibiæ having a spine, in the species before me all the tibiæ are mucronate: the author has neither mentioned the length of the posterior metatarsus nor the shape of the prosternum, but the other characters agree with his description; in three specimens the abdomen is flavous, in a single one the entire underside is black, but no other differences can be seen.

MALVERNIA, gen. n.

Oblong; the antennæ filiform, long, the 8th, 9th, and 10th joints moniliform, the terminal joint elongate, strongly thickened, with an additional appendage at the apex; thorax transverse, without sulcus; elytra irregularly punctured, epipleuræ broad at the base, indistinct below the middle; legs rather robust, the

posterior femora strongly dilated, the tibiæ with a minute spine, simple, non-sulcate, the first joint of the posterior tarsi as long as the following two joints together, claws appendiculate; prosternum nearly invisible; the anterior coxal cavities open.

The most characteristic feature of this genus, which in general shape resembles somewhat *Aphthona*, is to be found in the peculiar structure of the antennæ, which differs from every other genus of *Halticinæ*. In these organs, which have the lower joints very elongate and slender, the penultimate three joints are suddenly shortened and scarcely longer than broad, while the last is again elongate and thickened; the almost invisible prosternum is another peculiarity rarely met with in this tribe.

MALVERNIA VARICORNIS, sp. n. (Plate XXI. fig. 2.)

Black, the head, the lower joints of the antennæ, the thorax and legs fulvous; thorax distinctly but remotely punctured; elytra bluish black, shining, very strongly and closely punctured, the interstices subrugose.

Length 4 millim.

Head impunctate, fulvous, the frontal tubercles strongly raised, subquadrate, carina broad, flavous like the clypeus, the latter thickened, impunctate; antennæ nearly extending to the apex of the elytra, black, the lower three joints and the base of the fourth flavous, third joint double the length of the second, the fourth and the following three joints very elongate, the next three very short, terminal joint elongate, thickened, emarginate at its inner edge, with a short additional joint; thorax twice as broad as long, of equal width, the sides rounded, the angles acute, the surface sparingly and finely punctured, flavous or fulvous; scutellum black, triangular; elytra wider at the base than the thorax, black, with a slight bluish gloss, very strongly and closely punctured, the punctation somewhat regularly arranged here and there, the interstices slightly rugose; underside black, sparingly pubescent; legs fulvous, the posterior femora strongly thickened.

Hab. Malvern, Natal (*G. Marshall*).

HESPERA AFRICANA, sp. n.

Black, clothed with fine pubescence, the basal joints of the antennæ and the legs fulvous; the thorax and elytra minutely granulate, without punctures.

Length 4–5 millim.

Of oblong, rather depressed shape, black, and opaque; the head and the entire upper surface minutely granulate and clothed with very fine grey pubescence, the clypeus raised in shape of an acute central ridge; the antennæ long and slender, extending to the apex of the elytra, black, the lower two or three joints fulvous, the second joint very small, the third slightly shorter than the fourth, the latter and the following joints very elongate; thorax about one-half broader than long, the sides feebly, the posterior margin more distinctly rounded, the angles rather obsolete, the

surface depressed at the middle; elytra slightly wider at the base than the thorax, rather flattened, the apex of each rounded: underside black, more shining; legs fulvous, all the tibiæ mucronate, the first joint of the posterior tarsi longer than the following joints together; prosternum extremely narrow, the anterior coxal cavities open; posterior femora thickened; the last abdominal segment of the male deeply depressed; anterior coxæ very prominent.

Hab. South Africa (my collection).

The type of this genus was described by Weise from China, and the present African species almost entirely resembles it, except in the colour of the legs and its larger size, but I cannot find any structural differences sufficient to warrant its separation. The genus seems to represent a transitionary form between the *Halticinæ* and *Galerucinæ*, since the whole general shape and the almost indistinct prosternum resemble much more a species of the latter family; but the distinctly dilated posterior femora leave no doubt as to the real place of the insect.

JAMESONIA Jac.

This genus, originally described by me under the name of *Gabonia*, but subsequently altered to *Jamesonia*, seems to me to be identical with Weise's genus *Thrymnes* (Deutsche entom. Zeitsch. 1895). A renewed examination of other specimens since received has proved to me that I have wrongly given the anterior coxal cavities as closed; the opposite is the case, they are open. The name of *J. unicostata* seems also applicable only to the female sex of that species, as I have received lately a male specimen from Dr. Kraatz, obtained at the Cameroons, in which the elytra are without the transverse ridge near the apex: this specimen agrees, however, in everything else with the female types, except in having the entire head flavous. The species is evidently identical with *Thrymnes nucleus* Weise.

JAMESONIA WEISEI, sp. n.

Flavous, the apical joints of the antennæ and the posterior legs black; head impunctate, thorax with a few fine punctures; elytra scarcely more strongly punctured; tarsi fuscous.

Length 3 millim.

Head impunctate, the eyes large, the frontal elevations and the carina distinctly raised, labrum and mandibles piceous; antennæ black, the lower three or four joints flavous, the second and third joints small, equal, the fourth but slightly longer, the others more elongate; thorax nearly twice as broad as long, the sides slightly rounded, the angles not produced, the posterior ones slightly oblique, the surface nearly impunctate, shining, flavous; scutellum flavous, broader than long; elytra wider than the thorax at the base, slightly widened towards the middle, scarcely perceptibly punctured, when seen under a strong lens; below flavous, the posterior legs piceous or black, tarsi more or less dark coloured.

Hab. Boma, Congo (coll. Belgian Mus. and my own).

This small species differs from *Thrymnes nucleus* Weise in the flavous head and differently coloured antennæ and legs and nearly impunctate upper surface, and from *T. custos* likewise in the flavous head and scutellum. *T. bifoveatus* Weise is black below and has two elytral foveæ.

PODAGRICA (?) GLABRATA, sp. n.

Ovate, widened posteriorly, flavous, the apical joints of the antennæ and the elytra, breast, and abdomen black; thorax with a distinct transverse sulcus, impunctate; elytra not perceptibly punctured.

Length 3 millim.

Head impunctate, flavous, the frontal tubercles small, clypeus widened between the antennæ, apical joint of the palpi acute; antennæ filiform, extending to the middle of the elytra, flavous, the last four joints blackish; thorax transverse, twice as broad as long, the lateral margins distinctly rounded, the posterior angles produced into a small tooth, the surface strongly transversely convex, flavous, shining and impunctate, the base with a distinct transverse sulcus, which does not extend to the sides but is bounded laterally by perpendicular grooves or rather turns downwards to the base, another small transverse depression is placed near the anterior angles; scutellum small, black; elytra strongly convex and widened behind, much wider at the base than the thorax, black, shining, with traces of a few extremely minute punctures, only visible with a very strong lens here and there; legs flavous, all the tibiæ with a minute spine; the breast and abdomen black; prosternum moderately broad, elongate; the anterior coxal cavities closed.

Hab. Malvern, Natal (*G. Marshall*).

This small species differs from the typical form of *Podagrica* in its more convex and ovate shape and in the thoracic transverse sulcus. In the absence of other similarly structured species, however, I have for the present included the insect in *Podagrica*, to which at all events it is very closely allied. The elytra have a very narrow lateral reflexed margin, which is accompanied by a row of punctures, the only ones visible; the metatarsus of the posterior legs is as long as the following two joints together.

CREPIDODERA ZAMBIENSIS, sp. n.

Elongate, fulvous; head and thorax remotely and strongly punctured, the latter transversely sulcate; elytra dark blue, strongly punctured, the interstices longitudinally costate throughout.

Length 5 millim.

Of elongate and parallel shape, the head broad, strongly and remotely punctured at the vertex, the latter fulvous, lower portion of the face paler; frontal tubercles in shape of narrow transverse ridges, clypeus with an acute central ridge; antennæ rather long and slender, fulvous, the basal joint elongate, thickened at the

apex, the second, half the length of the third, the others nearly equal in length; thorax transverse, subquadrate, twice as broad as long, the sides very slightly rounded before the middle, the anterior angles oblique, not produced, posterior ones distinct, the surface with a narrow transverse sulcus, not quite extending to the lateral margins, the disc punctured like the head, fulvous, shining; scutellum fulvous; elytra dark blue, the extreme sutural margin and the epipleuræ fulvous, the disc strongly and closely longitudinally costate, each elytron with eight costæ and another short subsutural one, the interstices transversely rugose-punctate: underside and the legs fulvous, posterior femora moderately incrassate, the first joint of the posterior tarsi as long as the following joints together; prosternum narrow and strongly raised, the anterior coxal cavities closed.

Hab. Zambi, Congo (coll. Belgian Mus. and my own).

This insect differs from typical species of *Crepidodera* in the very narrow and strongly convex prosternum, also in the absence of a lateral perpendicular groove, which generally limits the transverse sulcation of the thorax; it should perhaps be placed in a separate genus.

CREPIDODERA NATALENSIS, sp. n.

Piceous, the antennæ and legs flavous, above obscure æneous; thorax very finely and closely punctured, with deep basal sulcus and lateral grooves; elytra finely punctate-striate, the interstices sparingly and minutely punctured.

Length 3 millim.

Head greenish æneous, entirely impunctate, with a short perpendicular groove immediately above the eyes, frontal elevations small; the clypeus with an acutely raised central ridge; the antennæ slender, flavous, the terminal joint stained with fuscous, the second joint scarcely shorter than the third, the terminal four joints slightly thickened; thorax about one-half broader than long, the sides straight at the base, rounded before the middle, the angles distinct but not acute, the surface very closely and finely punctured, greenish æneous, the basal sulcus very deep and bounded laterally by an equally deep longitudinal groove, which extends upwards some little distance, the basal portion behind the sulcus of more distinctly fulvous colour and likewise finely punctured; elytra elongate and convex, the apex rather pointed, the basal portion very feebly depressed, the disc rather strongly and very regularly punctate-striate, of the same colour as the thorax, the interstices very finely punctured; below and the legs flavous, the apex of the posterior femora more or less stained with piceous.

Hab. Estcourt, Natal (*G. Marshall*); also Dunbrody, S. Africa (*Rev. T. O'Neil*).

This little species must be closely allied to *C. tosta* Gerst. in regard to its obscure æneous coloration, but the impunctate head, very closely punctured thorax, and its distinct transverse basal sulcus prevent the insect being identified with the last-named

species. Mr. Marshall states that it was found on *Acacia horrida*, which seems to be frequented by a great number of other Phytophaga.

CHÆTOCNEMA MARSHALLI, sp. n.

Dark æneous; the antennæ very long, more or less fulvous as well as the four anterior tibiæ and tarsi; thorax finely and closely punctured; elytra deeply punctate-striate, the interstices slightly convex, impunctate.

Length 3½ millim.

Of elongate, posteriorly pointed shape, the vertex of the head rather strongly punctured above the eyes, the latter with a rather deep sulcus near their inner margins, which runs obliquely to the clypeus, this part rugosely punctured as well as the space in front of the eyes at the sides of the clypeus; antennæ slightly extending beyond the apex of the elytra, filiform, fulvous, the terminal joints sometimes darker, the second joint half the length of the first, the following ones very elongate; thorax rather more than twice as broad as long, the sides slightly rounded, the anterior angles somewhat prominent and obliquely thickened, the posterior margin accompanied by a finely impressed line, the surface transversely convex, finely and closely punctured; scutellum twice as broad as long, impunctate; elytra pointed posteriorly, with deep rows of transversely shaped punctures, the interstices raised and slightly punctured here and there; underside dark æneous, the abdomen finely punctured at the base of each segment, sparingly pubescent; posterior femora strongly incrassate, impunctate; tibiæ fulvous at the base, the four posterior ones armed with a stout tooth; tarsi fulvous; prosternum narrow, sulcate longitudinally; last abdominal segment with a short transverse ridge at the apex (♂?).

Hab. Malvern, Natal (*G. Marshall*).

The long antennæ, which extend beyond the elytra, will at once distinguish this species; in this respect it agrees with *C. longicornis* Jac., likewise from Natal, but that species is much smaller and has still longer antennæ, the thorax is finely rugose, and the legs are nearly black. Some specimens of *C. marshalli* are of a more opaque dull bluish colour, but I cannot find sufficient differences to justify a separation; in the female the antennæ are shorter, but still as long as the body.

CHÆTOCNEMA FREREENSIS, sp. n.

Below piceous, above dark æneous, basal joints of the antennæ and the tibiæ and tarsi more or less flavous; thorax very closely and finely punctured; elytra strongly punctate-striate, the interstices longitudinally costate near the apex, the latter pointed.

Length 2 millim.

Head impunctate, with the exception of a single deep puncture above the eyes, the sides with narrow oblique grooves which meet in front; clypeus broad, impunctate; the antennæ not extending to

the middle of the elytra, flavous, the terminal joints more or less fuscous, basal joint elongate and slender, the second and the following joints of equal length; thorax twice as broad as long, slightly narrowed in front, the sides nearly straight, with a narrow reflexed margin, the anterior angles thickened, basal margin unaccompanied by an impressed line, the surface finely and closely punctured; elytra ovate, pointed posteriorly, their base not wider than the thorax, strongly and closely punctate-striate, the interstices longitudinally costate at the sides and at the apex: underside and legs piceous, the tibiæ and tarsi more or less flavous; prosternum narrow, longitudinally sulcate.

Hab. Frere, Natal (*G. Marshall*).

CHÆTOCNEMA CARINATA, sp. n.

Greenish black below, the basal joints of the antennæ and the tibiæ and tarsi fulvous; above metallic green, the head with three transverse ridges, thorax finely punctured; elytra strongly punctate-striate, the interstices finely wrinkled.

Length 2–2½ millim.

Head rather elongate, perpendicularly deflexed, dark greenish, strongly and remotely punctured and minutely granulate at the lower portion; the clypeus deeply triangularly emarginate, the vertex with three acute transverse ridges, its base strongly rugose; the antennæ scarcely extending to the middle of the elytra, fulvous, the apical joints more or less fuscous, the third and fourth joints equal, but little longer than the second joint; thorax very short, nearly three times broader than long, the sides scarcely rounded, obliquely narrowed towards the apex, the surface finely and rather closely punctured and minutely granulate, metallic light green, the anterior and posterior margins accompanied by a finely impressed groove or line; scutellum much broader than long, cupreous; elytra not wider at the base than the thorax, strongly punctate-striate, the punctures very closely approached, the interstices slightly convex and very finely transversely wrinkled, the space between the first row of punctures and the suture irregularly punctate; below nearly black, with a slight metallic greenish gloss, posterior femora very strongly incrassate, blackish, the tibiæ and tarsi dark fulvous.

Hab. Moliro, Riv. Lulangoi, Congo (*F. Duvivier*) (coll. Belgian Mus. and my own).

This species is doubtless very closely allied to *C. cristata* Har. from the Zambesi River; but the latter insect is described as greenish æneous, and as having a single transverse ridge at the vertex of the head, while here there are three and the space behind these ridges is strongly rugose. The size of v. Harold's species is also smaller, other details of structure are not given.

NISOTRA OVATIPENNIS, sp. n.

Broadly ovate, obscure fulvous; thorax extremely closely and

finely punctured; elytra regularly punctate-striate, the interstices very sparingly punctured.

Length 4 millim.

Of broadly ovate shape; the head broad, very sparingly and finely punctured, with an oblique groove in front of the eyes, the latter very large; clypeus broad and thickened; antennæ not extending to the middle of the elytra, fulvous, the second joint slightly shorter than the third but thicker, terminal joints elongate; thorax transverse, nearly three times broader than long, the sides nearly straight, the anterior angles obliquely truncate with a small notch at each side, the posterior margin with a perpendicular short groove at each side, the surface closely and finely punctured throughout; elytra wider at the base than the thorax, widened towards the middle, the disc rather regularly and distinctly punctate-striate, the striæ widely placed, the interstices with a few fine punctures here and there, elytral epipleuræ very broad; legs short and robust, prosternum longer than broad; anterior coxal cavities closed.

Hab. Cameroons.

From other similarly coloured species the present insect is distinguished by the broadly ovate shape and the punctate-striate elytra. I received two specimens from Dr. Kraatz of Berlin.

NISOTRA COSTATIPENNIS, sp. n.

Pale fulvous; the thorax finely and closely punctured, with deep basal perpendicular grooves; elytra strongly punctate-striate, the interstices longitudinally costate and finely punctured.

Length 4 millim.

Nearly parallel in shape; the head impunctate, obliquely grooved between the eyes; the clypeus broad, widely separating the antennæ at the base, labrum fulvous; antennæ nearly extending to the middle of the elytra, fulvous, the third and fourth joints equal; thorax strongly transverse, the sides slightly rounded before the middle, the anterior angles obliquely truncate, the basal margin with a deep and long perpendicular groove at each side, nearly extending to the middle, the surface finely and closely punctured; elytra strongly punctate-striate, the punctures closely placed, the interstices convex and finely punctured; underside and legs coloured like the upper surface.

Hab. Cameroons.

Although I have received only a single, apparently female, specimen from Dr. Kraatz, I think the species varies sufficiently from any of its allies to be of certain recognition; the thoracic basal grooves are more than usually large and deep, and the elytral interstices differ from those of every other species in being longitudinally costate, peculiar perhaps to the female only.

NISOTRA UNIFASCIATA, sp. n.

Fulvous, the terminal joints of the antennæ fuscous; thorax

very closely and distinctly punctured; elytra strongly punctate-striate, the interstices finely punctured, each elytron with a longitudinal fuscous band, abbreviated behind, and the apex fuscous.

Length 4 millim.

Of parallel shape; the head impunctate, obsoletely sulcate in front of the eyes; clypeus separated from the face by a transverse groove, rather deflexed, impunctate, palpi slender; antennæ extending slightly beyond the base of the elytra, fulvous, the terminal four or five joints fuscous, the third joint slender, longer than the fourth one, terminal joints thickened; thorax twice as broad as long, the sides slightly and evenly rounded, the anterior angles slightly oblique but not produced, the basal margin with a short but deep longitudinal groove, the surface extremely closely and rather strongly punctured throughout; elytra with regular rows of strong punctures, closely placed, the interstices very finely punctured, fulvous, the extreme lateral margin, the apex in shape of a triangular spot, and a narrow longitudinal stripe at the middle of each elytron nearly black, the latter abbreviated before the apex; underside and legs fulvous.

Hab. Niger-Benue Expedition (*Staudinger*).

I have received two specimens of this very distinct species from Dr. Staudinger.

NISOTRA UNIFORMA, sp. n.

Pale fulvous, the terminal joints of the antennæ darker; thorax finely and closely punctured, the basal sulci short and deep; elytra closely and finely punctured, the punctation partly geminate-striate.

Length 3–4 millim.

Head very finely and somewhat closely punctured, the clypeus with some stronger punctures; the antennæ nearly extending to the middle of the elytra, black, the lower five or six joints fulvous, the third joint slightly longer and more slender than the following two joints, terminal ones thickened; thorax more than twice as broad as long, the sides straight at the base, rounded at the middle, the anterior angles scarcely oblique or prominent, the perpendicular basal grooves short and deep, the disc rather convex, finely and rather closely punctured; elytra with closely approached double rows of fine punctures, more or less distinct; underside and legs pale fulvous.

Hab. Sierra Leone, Rhobomp, Niger-Benue Expedition (*Staudinger*).

Although this species seems very closely allied to *N. testacea* Chap. and *N. chapuisi* Jac. from Madagascar, I think it sufficiently different to be considered distinct. *N. testacea*, of which the description is scarcely detailed enough, is said to have a dark breast and abdomen, as well as similarly coloured posterior femora.

NISOTRA APICALIS, sp. n.

Obscure fulvous, the apical joints of the antennæ fuscous; thorax transverse, finely and closely punctured; elytra strongly punctate-striate, fuscous, the apex more or less pale fulvous.

Length 3 millim.

Ovate and convex, pointed posteriorly; the head impunctate, fulvous, the frontal elevations indistinct, the labrum and palpi fulvous; the antennæ only reaching the base of the elytra, fulvous, the terminal joints more or less piceous, the third joint more slender and slightly longer than the fourth joint, the apical joints slightly thickened; thorax at least twice as broad as long, the sides evenly and moderately rounded, the anterior margin straight, the posterior one strongly produced at the middle and rounded, impressed at each side with a short, slightly oblique perpendicular groove, the surface very finely and closely punctured; elytra gradually widened towards the middle, rather strongly punctured, the punctures somewhat irregularly arranged in rows, distinct to the apex, the latter flavous, the rest of the surface fuscous, the two colours generally well divided; below and the legs fulvous; prosternum narrow; the breast and abdomen nearly impunctate.

Hab. Rhobomp, Sierra Leone.

Smaller than *N. spadicea* Dahlm., of different coloration and with single not geminate elytral punctation.

NISOTRA CONGOENSIS, sp. n.

Fulvous; the thorax finely and closely punctured, the base with two perpendicular grooves; elytra deeply punctate-striate, the interstices finely punctured, flavous, the disc with a broad longitudinal black band, not extending to the apex.

Var. The elytral band divided into a basal and subapical spot.

Length 4 millim.

Head convex, extremely minutely punctured, the eyes bounded within by a deep sulcus; clypeus narrow, strongly raised; antennæ fulvous, extending to the base of the elytra only, the second and the following joints very nearly equal, all rather thickened, terminal joint more elongate; thorax twice as broad as long, the sides evenly rounded, the angles acute, the surface very closely and finely punctured, flavous or fulvous, the basal margin with a rather deep and long perpendicular groove at each side; scutellum flavous; elytra ovate, very strongly and deeply punctate-striate, the interstices minutely punctured and longitudinally costate, each elytron with a broad longitudinal black band abbreviated near the apex and constricted at the middle; underside and the legs fulvous; tibiæ mucronate; prosternum narrowed between the coxæ.

Hab. Chiloango, Congo. Belgian Mus. collection and my own.

Closely allied to *N. unifasciata* Jac. and of similar coloration, but the antennæ entirely fulvous, and the elytra very deeply and regularly punctured, with the interstices costate and the lateral

margins of the ground-colour. In the type the elytral band is strongly narrowed near the middle and in the variety it is entirely divided into two spots.

AMPHIMELA ORNATA Jac.

Aberration. Thorax and elytra yellowish white, the latter with the suture, a spot on the shoulder, another at the apex, a short transverse band at the middle, and a very small spot near the scutellum black; antennæ and legs pale testaceous, the posterior femora black.

Hab. Isipingo, Natal (*G. Marshall*).

This variety or aberration I must refer to the species previously described by me, but the elytral bands have been reduced to spots; the latter exactly indicate the position of the bands in the type, the sculpturing and everything else is the same.

ALLOMORPHA AFRICANA, sp. n.

Below fuscous or piceous, the head and thorax pale fulvous, finely wrinkled and pubescent; antennæ (the basal joints excepted) black; elytra flavous, finely granulate and punctured, the sutural and lateral margins piceous; legs flavous, the posterior femora piceous at the apex.

Length 2½–3 millim.

Head very finely punctured and granulate, the frontal tubercles short and broad but distinct; eyes ovate, entire, rather large; antennæ nearly as long as the body, black, the lower three joints fulvous, the third and following joints elongate, nearly equal; thorax about one half broader than long, the sides nearly straight, very slightly widened towards the apex, the anterior angles thickened, the posterior margin slightly rounded, the surface very finely rugose and punctured, fulvous, clothed with very short yellowish pubescence; scutellum small, black; elytra of paler colour than the thorax, wider than the latter, extremely finely transversely wrinkled or rugose throughout, closely covered with short yellowish hairs, the sutural and lateral margins narrowly black; legs flavous, the posterior femora piceous at the apex, tarsi fuscous.

Hab. Malvern, Natal (*G. Marshall*).

This is the first species of the genus recorded from Africa, the other three having been obtained in India and the Malayan region. I cannot find, however, sufficient structural differences to separate them from the genus, the principal characters of which are to be found in the pubescent upper surface, the subquadrate thorax without sulcus, the absent or indistinct elytral epipleuræ below the middle, the rather long metatarsus of the posterior legs, and in the scarcely visible prosternum and closed coxal cavities. All this would agree better with the group *Galerucinæ*, but the distinctly incrassate posterior femora do not allow the placing of the insect in the latter section. I received two specimens of the present insect from Mr. G. Marshall.

NOTOMELA, gen. n.

Body oblong; antennæ widely separated, very short, the terminal joints transverse, palpi subfiliform; thorax transverse, without depressions; elytra glabrous, geminate punctate-striate; legs short and robust, the posterior femora strongly incrassate, the tibiæ widened at the apex, deeply sulcate, the four posterior ones mucronate; claws appendiculate; prosternum much narrowed between the coxæ; mesosternum short, deeply bilobed posteriorly; the anterior cotyloid cavities closed.

There are but few genera of *Halticidæ* which agree with the present one in the widely separated antennæ and the punctate-striate elytra; and although I have only a single specimen before me, the structural differences of the species are so well marked that it will be easy to recognize the insect, which would perhaps best be placed near *Amphimela* Chap., which is, however, of strongly rounded shape.

NOTOMELA CYANIPENNIS, sp. n.

Reddish fulvous, the apical joints of the antennæ fuscous; thorax strongly and closely punctured; elytra dark metallic blue, strongly geminate punctate-striate, longitudinally costate near the lateral margin.

Length 3 millim.

Head fulvous, closely and strongly punctured, the frontal tubercles in shape of narrow transverse ridges; clypeus deeply separated from the face by a transverse groove, broader than long; antennæ scarcely extending beyond the base of the thorax, fulvous, the last four or five joints fuscous, the basal joint thickened, curved and moderately long, the second short, the third twice as long, the others shorter and gradually transversely thickened; thorax more than twice as broad as long, widened at the middle, the sides rounded before the middle, the anterior angles thickened, the surface closely and strongly punctured, but more so at the sides, where the punctures are large and round; scutellum triangular, fulvous; elytra not wider at the base than the thorax, dark metallic blue, each elytron with nine or ten double rows of strong punctures, the lateral margin strongly thickened in shape of a costa; underside and legs fulvous, abdomen subremotely punctured; the first joint of the posterior tarsi shorter than the following two joints together.

Hab. Cameroons, West Africa (*Conrad*).

This species much resembles those of the genus *Australica* amongst the *Chrysomelidæ* in its general shape. I received a specimen from Dr. Kraatz, of Berlin.

HALTICELLA, gen. n.

Rounded, convex; the eyes surrounded by a sulcus; the antennæ subfiliform; thorax transverse, without depressions or sulci; elytra semiregularly punctate-striate, their epipleuræ broad; posterior

femora very strongly incrassate, their tibiæ straight, distinctly sulcate, widened posteriorly, with a strong spur placed at the middle of the apex, their metatarsus as long as the following three joints together, claws appendiculate; prosternum narrowly elongate, mesosternum narrowly transverse; the anterior coxal cavities closed.

Amongst the genera with closed anterior coxal cavities there is only one which has the eyes surrounded by a similar although broader sulcus—the genus *Orthœa* Jac. from Burmah. But in addition to this character the thorax in the latter genus is also provided with perpendicular grooves at the base, which are absent in the genus characterized here, and in which the metatarsus of the posterior legs is also proportionately longer and the antennæ have more elongate joints.

HALTICELLA FLAVOPUSTULATA, sp. n.

Rounded, convex, fulvous; antennæ and the anterior legs flavous; horax closely and finely punctured; elytra closely punctured, with bsolete rows of deeper punctures, obscure piceous, a transverse spot near the middle and another near the apex flavous.

Length 2½ millim.

Head finely punctured, with a narrow sulcus above the eyes, fulvous with a slight metallic gloss; the clypeus separated from the face by a narrow transverse groove, frontal tubercles absent; palpi slender, flavous; antennæ not extending to the middle of the elytra, flavous, the second and third joints of equal length, the following slightly longer and thicker; thorax nearly twice as broad as long, the sides nearly straight and obliquely narrowed towards the apex, the posterior margin rounded, the anterior angles slightly thickened, the surface closely and distinctly punctured, fulvous, the disc rather darker; elytra ovate, convex, and pointed at the apex, punctured in the same way as the thorax, but with obsolete rows of stronger punctures, more strongly marked at the sides, where the last two interstices are slightly longitudinally costate, the disc of an obscure piceous colour, a rather large slightly oblique spot placed close to the middle and another smaller one near the apex, obscure flavous; posterior femora strongly incrassate, pale piceous, the anterior legs flavous.

Hab. Natal, Frere. I received two specimens from Mr. Peringuey.

GALERUCINÆ.

IDACANTHA WEISEI, sp. n. (Plate XXI. fig. 4.)

Flavous, the antennæ (the basal joints excepted), the breast, and the legs black; thorax sparingly punctured at the sides; elytra black, nearly impunctate.

Mas. The third joint of the antennæ broadly dilated and excavated; the scutellum with the sides raised into strong ridges, the apex reflexed; the elytra with two fulvous tubercles at the basal margin.

Length 5 millim.

Head and palpi flavous, the former impunctate; antennæ extending beyond the middle of the elytra, black, the lower four joints flavous, basal joint slender, second very short, third strongly dilated and excavated at its apex, fourth much shorter and widened into a tooth at the upper edge, the other joints slender; thorax transverse, with rounded sides, the disc with a deep transverse sulcus, interrupted at the middle, remotely punctured at the anterior portion only, flavous; scutellum subquadrate, flavous, deeply excavated, the sides raised into high ridges; elytra rather strongly depressed below the base, the basal portion near the scutellum raised and furnished with a small fulvous tubercle on each elytron, rest of the surface with a few fine punctures only, black, very shining; abdomen flavous, trilobate at the last segment, the middle lobe much broader than long, flat; all the tibiæ mucronate, claws deeply bifid.

Hab. Cameroons (*Conrad*).

The single male specimen which I received from Dr. Kraatz is readily distinguished by the structure of the scutellum, in which it nearly agrees with *Aulacophora scutellata* Baly; but in that species the antennæ are simple, the shape of the scutellum is different, and the abdomen is not flavous.

ASBECESTA DUVIVIERI, sp. n.

Black, the basal joints of the antennæ and the legs flavous; thorax nearly impunctate, flavous; elytra closely and distinctly punctured, flavous, margined with black.

Length 5 millim.

Head black, impunctate, the frontal tubercles and the clypeus strongly raised; antennæ not extending to the middle of the elytra, the lower five or six joints flavous, the rest black, the terminal two joints much more elongate than the others, third and fourth joints equal. Thorax one-half broader than long, the sides rounded, the basal sulcus strongly marked, the surface with a few minute punctures here and there; scutellum black; elytra longitudinally depressed near the lateral margins and with another shorter depression at the sides, rather strongly and closely punctured, flavous, all the margins rather broadly black, the humeral callus also with a short blackish mark within; below black, the legs flavous.

Hab. Moliro, Congo (*J. Duvivier*) (Belgian Mus. collection and my own).

Much smaller and narrower than *A. marginata*, the underside black not flavous, and the elytral margins more broadly black, the legs unicolorous.

ASBECESTA MARGINATA, sp. n. (Plate XXI. fig. 5.)

Flavous, the antennæ, the apex of the tibiæ, and the tarsi black, the head and thorax with a black spot; elytra closely and finely punctured, testaceous, narrowly margined with black.

Length 7 millim.

Head flavous, the vertex rugose at the sides, the middle impunctate, with a black spot, labrum and apex of the mandibles black, frontal tubercles broad, transverse, carina distinct; antennæ short, black, the basal joint pale below, intermediate joints triangularly widened, terminal ones moniliform, apical joint ovate, pointed; thorax twice as broad as long, the sides nearly straight, the surface deeply transversely sulcate, with a few fine scattered punctures, flavous, the anterior portion with a black central spot; scutellum black; elytra paler than the thorax, finely and closely punctured, the sutural and lateral margins very narrowly black; below and the legs flavous, the tibiæ below and at the apex and the tarsi black.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Closely allied to *A. capense* Alld., but differing in the black elytral margins, which are constant in all the specimens that Mr. Marshall obtained.

ASBECESTA POLITA, sp. n.

Flavous, the head and the antennæ black, apical joints of the latter flavous; thorax impunctate; elytra closely and rather strongly punctured.

Length 5 millim.

Head impunctate, black, the frontal tubercles broad and distinct; labrum testaceous, stained with piceous; the antennæ extending to the middle of the elytra, robust, black, the basal joints below and the base of each following joint fulvous, the apical three joints flavous; thorax twice as broad as long, the sides straight, the anterior angles slightly produced into a small tubercle, the disc transversely sulcate at the middle, entirely impunctate, flavous; scutellum impunctate, flavous; elytra slightly widened posteriorly, rather strongly and closely punctured, the interstices slightly wrinkled here and there; below and the legs flavous, claw-joints piceous.

Hab. Cameroons (*Conrad*).

Distinguished from all its allies by the colour of the head and that of the antennæ. I received a single specimen from Dr. Kraatz.

MALACOSOMA MELANOCEPHALUM, sp. n.

Black, head finely granulate; thorax fulvous, transverse, minutely punctured; elytra fulvous, finely and closely punctured, the interstices finely wrinkled; legs partly piceous and fulvous.

Length 4 millim.

Elongate and parallel; the head black, broad, very finely granulate at the vertex and minutely punctured, the frontal tubercles strongly raised but nearly joined and forming a single piece with the clypeus, anterior edge of the latter straight, labrum and palpi testaceous; antennæ extending beyond the middle of the elytra,

entirely black, the basal joint elongate and slender, the second and third joints short, equal, the following ones rather robust; thorax more than one-half broader than long, the lateral margins evenly rounded, posterior margin nearly straight, the angles not produced, the surface extremely finely and rather closely punctured, fulvous, shining; scutellum black; elytra slightly wider at the base than the thorax, parallel, fulvous, much more strongly and distinctly punctured than the thorax, the interstices slightly wrinkled or rugose; underside and the basal portion of all the femora piceous; tibiæ and tarsi flavous, the first tarsal joint of the posterior legs as long as the following two joints together.

Hab. Malvern, Natal (*G. Marshall*).

Rather larger than *M. capitatum* Jac., and differing from that species in the finely granulate head and the totally different shape of the frontal elevations as well as in the sculpture of the elytra; the male has the last abdominal segment incised at each side, the median lobe is smooth and slightly concave.

MALACOSOMA GERSTAECKERI, sp. n.

Below black or flavous, antennæ (the basal joints excepted) black; thorax subquadrate, nearly impunctate; elytra extremely minutely and rather closely punctured.

Length 3–4 millim.

Narrowly elongate; the head impunctate, rather darker than the other parts, the frontal elevations strongly transverse, the carina linear, very distinct, the palpi piceous; the antennæ extending beyond the middle of the elytra, slender, black, the lower three or four joints flavous, the second and third joints of equal length, one-half shorter than the following joint, the others of nearly the same length; thorax one-half broader than long, the lateral margins rather distinctly rounded and produced at the middle, straight at the base; the disc with some extremely minute punctures, only visible under a strong lens; elytra broader at the base than the thorax, parallel, extremely finely punctured in closely approached irregular rows, the apex of each rounded; underside and legs flavous, or black with the last abdominal segment flavous only, the posterior femora rather thickened; all the tibiæ mucronate, the first joint of the posterior tarsi as long as the following two joints together, claws appendiculate, the prosternum extremely narrow and convex the anterior coxal cavities open.

Hab. Frere, Estcourt, Malvern, Natal (*G. Marshall*).

Smaller than *M. capitatum*; the head fulvous not black, the antennæ with more slender joints and the thorax less transverse, more elongate, the metatarsus of the posterior legs also distinctly more elongate; the underside varies from fulvous to black, the last two segments of the abdomen being only of the former colour in some specimens; the male organ is very narrow and slender and its apex only slightly pointed. The female is of more robust and slightly larger shape, and the last abdominal segment has a short and broad fovea at the apex.

MALACOSOMA APICIPENNE, sp. n. (Plate XXI. fig. 3.)

Black, the apex of the elytra and the abdomen flavous; thorax subquadrate, very finely punctured; elytra more strongly and extremely closely punctured, the interstices finely rugose.

Length 8 millim.

Of elongate and parallel shape; the head with a few minute punctures, frontal elevations broad and transverse; clypeus very narrow, in shape of a ridge, the middle portion broad and extending upwards; labrum piceous, margined with flavous; antennæ rather short and robust, black, the third joint one-half longer than the second, the fourth as long as the preceding two joints together, the terminal two joints more elongate; thorax subquadrate, one-half broader than long, the sides rounded, anterior angles with a small tubercle, the surface rather convex, black and shining, finely but not closely punctured; scutellum triangular, broad, impunctate; elytra elongate and parallel, black, extremely closely and distinctly punctured, the punctures of different sizes, the interstices finely wrinkled and rugose, the apex flavous; below and the legs black, clothed with grey rather long pubescence, all the tibiæ mucronate; the anterior coxal cavities open.

Hab. Moliro, Congo (*Duvivier*). Belg. Mus. collect. and my own.

LUPERODES SULFURIPENNIS, sp. n.

Black, the basal joints of the antennæ and the legs fulvous; above pale flavous; the head and thorax impunctate; elytra extremely finely and closely punctured.

Length 9 millim.

Broadly ovate; the head impunctate, fulvous at the vertex, the lower portion flavous, frontal elevations trigonate, distinct, clypeus triangularly convex; antennæ black, the lower three joints fulvous, third joint twice as long as the second, one-half shorter than the fourth; thorax nearly twice as broad as long, the sides moderately, the posterior margin more strongly rounded, the anterior angles thickened, not produced, the surface impunctate, flavous; scutellum and elytra of the same colour, the elytra minutely and very closely punctured, their epipleuræ very broad at the base, continued below the middle; the breast and abdomen black, clothed with fine flavous pubescence; legs fulvous, all the tibiæ with a distinct spine, the metatarsus of the posterior legs longer than the following joints together; anterior coxal cavities open.

Hab. Port Alfred, South Africa (*Rev. O'Neil*).

A broadly ovate species, of which I received a single specimen sent by the Rev. T. O'Neil from S. Africa.

OOTHECA LÆVIPENNIS, sp. n.

Black, lower part of the face flavous; thorax subquadrate, pale fulvous, impunctate; elytra of the same colour, shining, without punctures.

Length 6 millim.

Of ovate convex shape; the head impunctate, flavous, the vertex black and shining, the frontal tubercles strongly developed, transverse; labrum black; the antennæ rather stout, black, the basal joint short and thick, the second short, the third twice as long, the following joints slightly thickened and more elongate; thorax about one-half broader than long, the sides rounded, the posterior angles obliquely rounded, posterior margin truncate at the middle, the surface entirely impunctate, shining, pale fulvous; scutellum broad, black; elytra widened towards the middle, convex, entirely impunctate, their epipleuræ disappearing at the middle; below and the legs black, all the tibiæ with a spine; the anterior coxal cavities open.

Hab. Bedford, Pt. Elizabeth, S. Africa (*Rev. O'Neil*).

The entirely impunctate upper surface of this species at once distinguishes it from *O. mutabilis*.

LUPERUS FLAVICINCTUS, sp. n.

Black; basal joints of the antennæ, the thorax and the legs flavous; thorax impunctate; elytra bluish black, finely punctured, the lateral margins below the middle broadly flavous, the disc with some single hairs.

Length 4 millim.

Head entirely impunctate, black, shining, frontal elevation strongly developed, elongate; clypeus thickened; antennæ extending beyond the middle of the elytra, black, the lower three joints flavous below, the second and third joints small, nearly equal, following joints more elongate; thorax subquadrate, scarcely broader than long, the sides slightly constricted at the base, feebly rounded at the middle, the angles dentiform, the surface entirely impunctate, flavous, very shining; scutellum black; elytra much wider at the base than the thorax, convex, slightly widened at the apex, bluish black, the surface finely and closely punctured, the interstices finely wrinkled, the lateral and apical margins from the middle broadly flavous; the breast and abdomen black, the legs flavous, the tarsi more or less fuscous, the metatarsus of the posterior legs as long as the following joints together.

Hab. Cameroons (*Conrad*).

LUPERUS DISCICOLLIS, sp. n.

Black, the sides of the thorax, the femora, and the abdomen flavous; thorax impunctate; elytra finely punctured and minutely granulate.

Length 5 millim.

Head rather elongate, black, impunctate, the frontal elevations subquadrate, nearly contiguous; clypeus broad, triangular, strongly raised; eyes large; the antennæ black (the terminal two joints wanting), basal joint thickened, the second scarcely shorter than the third joint, fourth as long as the preceding three joints together; thorax about one-half broader than long, the sides

nearly straight, the angles slightly thickened, the disc impunctate, the sides broadly fulvous, the middle occupied by a broad, posteriorly narrowed black band; scutellum black; elytra much wider at the base than the thorax, widened below the middle, black, shining, very finely but not very closely punctured, the interstices extremely finely granulate, their epipleuræ broad anteriorly, much narrowed towards the apex; below black, abdomen and the femora flavous, the tibiæ (their base excepted) and the tarsi fuscous, all the tibiæ mucronate, the first joint of the posterior tarsi as long as the following joints together.

Hab. Cameroons (*Conrad*).

I received a specimen of this well-marked species from Dr. Kraatz.

Poëphila costatipennis, sp. n.

Elongate, piceous; the head, basal joints of the antennæ, and the thorax fulvous, the latter finely and sparingly punctured; elytra metallic violaceous blue, strongly punctate-striate, the interstices longitudinally costate.

Length 2¼ millim.

Head impunctate, the eyes large, frontal elevations narrow, carina very acute, palpi thickened; antennæ filiform, extending to the middle of the elytra, black, the lower three joints fulvous, the second joint thickened, the third but slightly longer, thin, the following more elongate; thorax transversely subquadrate, convex, twice as broad as long, the sides straight, forming an oblique angle anteriorly, extending to the base of the eyes, this angle slightly thickened, posterior margin broadly produced at the middle, the surface with a deep transverse sinuate sulcus, parallel to the basal margin and not extending to the sides, the disc very finely and remotely punctured; scutellum piceous; elytra with a distinct depression below the base, the latter raised, the shoulders prominent, the punctation strong, close and deep, the interstices longitudinally costate, especially so at the sides; underside and legs nearly black, the metatarsus of the posterior legs longer than the following joints together; claws appendiculate, prosternum longer than broad; the anterior coxal cavities open.

Hab. Cameroons.

The only other representative of this genus, described by Weise, agrees almost entirely with the present insect, except in coloration, being rufo-testaceous with brown elytra and having no costæ on the latter parts; but of the fine pubescence of the eyes, of which Weise speaks, I am not able to discover a trace in my species, neither has this author mentioned the structure of the antennæ nor their colour, which must have been an oversight.

I received a specimen from Dr. Kraatz.

Poëphila fulvipes, sp. n.

Flavous, the antennæ (the basal three joints excepted) black;

thorax strongly punctured; elytra metallic dark blue, strongly punctate-striate, the interstices longitudinally costate.

Length 2½ millim.

Very closely allied to the preceding species, but apparently distinct; the head with some strong punctures anteriorly, the third joint of the antennæ longer, the thorax much less transverse and convex, only about one-half broader than long, the surface very deeply but not very closely punctured; the elytra as in the preceding species; the entire underside and legs fulvous.

Hab. Cameroons. Received from Dr. Kraatz.

The above-mentioned differences are, I think, sufficient to separate this species, and are probably not sexual, although I have only a single specimen before me; the structure and sculpture of the thorax differ too much to allow the insect to be united to *P. costatipennis*, with which it otherwise agrees in generic details.

APOPHYLIA MARGINATA, sp. n.

Fulvous, the upper portion of the head metallic greenish or blue, thorax with three or four bluish spots; elytra dark blue, finely transversely wrinkled, the lateral and apical margins fulvous, breast black.

Var. Underside black.

Length 6 millim.

Upper portion of the head finely punctured, dark blue with two fulvous spots or entirely blue, frontal elevations narrowly transverse, lower portion fulvous or flavous; antennæ extending to about the middle of the elytra, fulvous, the apex of each joint stained with fuscous, the terminal three or four joints entirely of that colour, third joint shorter than the fourth; thorax twice as broad as long, the sides rounded, the anterior angles slightly thickened, the posterior ones oblique and rather indistinct, the surface finely and closely punctured and partly rugose, with some obsolete depressions anteriorly; the disc fulvous, with three bluish spots, the middle one in shape of a V or separated into three smaller spots placed triangularly; scutellum black; elytra finely transversely wrinkled, the interstices finely punctured, dark blue, the lateral margin and the apical one more broadly fulvous, their epipleuræ broad anteriorly, very narrowed below the middle; the breast and the abdomen black, finely pubescent, or the breast only of that colour; the legs fulvous, the third joint of the tarsi fuscous, the first joint as long as the following joints together; anterior coxal cavities open.

Hab. Natal, on willow (*G. Marshall*).

This species seems allied in coloration to *A. nobilitata* Gerst., but differs in having the entire upper portion of the head green as well as in the colour of the underside and some other details. *A. consanguinea* Alld. is described as having a green longitudinal thoracic band, also with three æneous spots on the vertex.

ERGANA CHAPUISI, sp. n.

Fulvous, the breast and the legs black; thorax very closely and distinctly punctured; elytra dark bluish, closely and finely punctured.

Length 5 millim.

Head impunctate, fulvous, the frontal tubercles very strongly raised; antennæ short and robust, flavous, the joints nearly moniliform, the third and fourth joints more elongate; thorax one-half broader than long, the sides rounded, the angles acute, the surface very closely and distinctly punctured, fulvous; scutellum fulvous; elytra dark blue, closely aud strongly punctured, their epipleuræ broad and continued to the apex; below piceous or black, the abdomen flavous; all the tibiæ mucronate, the tarsi short, the anterior coxal cavities closed.

Hab. Moliro, Congo (*Duvivier*). Belgian Mus. collect. and my own.

This species agrees in every respect with the type of the genus, *E. protea* Chap. from Abyssinia, and it is possible that it only represents another variety of this variable species; but as I have two specimens before me perfectly identical, and as the elytra in *E. protea* show no trace of blue, I must look upon the present insect as distinct.

MEGALOGNATHA IMMACULATA, sp. n.

Elongate, parallel, testaceous; head and thorax impunctate; elytra obscure fulvous, extremely finely and sparingly punctured.

Length 7 millim.

Head broad, impunctate; frontal tubercles strongly raised, transverse; clypeus equally strongly raised, in shape of a triangular ridge; palpi robust; antennæ rather stout, flavous (the last three joints wanting), basal joint elongate, slightly curved, the third and the following joints nearly equal in length; thorax much broader than long, the sides slightly constricted at the base, nearly straight, the anterior angles thickened, the surface impunctate, obsoletely transversely sulcate; scutellum triangular; elytra much wider at the base than the thorax and of darker fulvous colour, the shoulders rather prominent and bounded within by a longitudinal depression, the disc extremely finely and sparingly punctured; underside and legs testaceous, finely pubescent, the first tarsal joint as long as the following joints together, claws appendiculate.

Hab. Estcourt, Natal (*G. Marshall*).

Allied in coloration to *M. ventricosa* Baly, but the thorax impunctate and differently sculptured, the general shape more parallel, and the colour of the antennæ and legs different. The two specimens obtained are probably females; the sulcation of the thorax resembles more semi-separate foveæ than a continued groove, but is more distinct in one of the specimens than in the other.

HEMIXANTHA, gen. n.

Body elongate and parallel; antennæ filiform, the third joint slightly longer than the second, but shorter than the fourth; thorax transverse without depressions, the sides rounded; elytra not narrower than the thorax, irregularly punctured and rugose, their epipleuræ broad anteriorly, indistinct below the middle; legs slender, the tibiæ unarmed, the first tarsal joint of the posterior legs as long as the following three joints together, claws appendiculate, the prosternum indistinct; the anterior coxal cavities closed.

This genus will enter the group of *Platyxanthinæ* on account of the unarmed tibiæ and closed coxal cavities, but it must be separated from *Platyxantha* on account of the differently shaped and structured thorax; the latter genus contains already far too many species of different kind of structural characters than the type, and wants revision. *Metrioidea* Fairm. has a subquadrate thorax, narrower than the elytra, and the same is the case in *Platyxantha* proper, in which the thorax is also more or less depressed or sulcate and not transverse. In *Hemixantha* must also be arranged the following species formerly placed by me in *Platyxantha*:—*H. pallida* Jac., *H. scutellata* Jac., which, although not metallic in coloration, exhibit the same structural characters.

HEMIXANTHA NATALENSIS, sp. n. (Plate XXI. fig. 8.)

Bluish or greenish black below, above metallic green or blue, the antennæ and tarsi black; thorax closely punctured and rugose; elytra as closely punctured and finely transversely wrinkled throughout.

Length 4 millim.

Head finely punctured at the vertex, the frontal tubercles very broad, subquadrate, and strongly raised; clypeus in shape of a transverse acute ridge; labrum black; antennæ extending beyond the middle of the elytra, slender, black, the lower three or four joints more or less fulvous below, the basal joint metallic dark green or bluish above; thorax twice as broad as long, transversely convex, the sides rather strongly rounded and widened at the middle, the angles distinct, the surface very closely and distinctly punctured, the interstices irregularly rugose or wrinkled; scutellum rather broader than long, impunctate; elytra parallel, scarcely narrower at the base than the thorax, the surface nearly similarly sculptured to that of the thorax, but the interstices more finely transversely wrinkled and minutely granulate; underside black, with a slight bluish or greenish gloss, the legs more distinctly of the latter tint, finely pubescent.

Hab. Frere, Natal (*G. Marshall*).

In the male insect the last abdominal segment is semicircularly emarginate at the apex, and the protruding penis is slender and pointed and slightly curved at the apex.

HEMIXANTHA INCONSPICUA, sp. n.

Elongate, convex, black, above obscure testaceous or fuscous; head with one, thorax with several confluent greenish-black spots, finely punctured; elytra very finely and closely punctured.

Var. Thorax obscure fulvous, the disc darker.

Length 8 millim.

Of parallel convex shape; the head finely and closely punctured, obscure fulvous, the vertex with a round greenish-piceous spot, frontal tubercles small but rather broad; eyes large; antennæ extending to the middle of the elytra, black, filiform, the third joint one-half longer than the second, but distinctly shorter than the fourth; thorax one-half broader than long, the sides rounded, the anterior angles in shape of a small tubercle, the surface somewhat depressed, covered with small and larger punctures, the disc more or less distinctly marked with greenish-piceous confluent spots; scutellum broad, black; elytra wider at the base than the thorax, nearly similarly punctured; underside and legs nearly black, finely pubescent, the tibiæ unarmed, the first joint of the posterior tarsi as long as the following three joints together, claws appendiculate, prosternum indistinct; the anterior coxal cavities closed.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Nearly allied to *H. scutellata* Jac. and *H. piceipes*, but larger and with entirely black antennæ, underside, and legs, the head and thorax spotted. The specimens were obtained in sweeping during the months of September and December in marshy places. The head is more closely and distinctly punctured than in *H. piceipes*, the eyes and the frontal elevations are larger, and the scutellum is broad and black.

HEMIXANTHA PICEIPES, sp. n.

Head and thorax obscure fulvous, very finely punctured; the antennæ, breast, and legs piceous or black; elytra more or less fuscous, extremely finely punctured and transversely wrinkled.

Var. The base of the head and the margins of the thorax flavous, disc of the latter and the elytra and underside piceous.

Length 6–7 millim.

Head finely punctured, the vertex longitudinally grooved at the middle, frontal elevations rather broad, the clypeus narrowly triangular; eyes large in the male, smaller in the female; antennæ scarcely extending to the middle of the elytra, black, the third joint double the length of the second, the following joints more elongate; thorax nearly twice as broad as long, the sides rounded at the middle, the anterior angles slightly produced, posterior angles rounded, the disc extremely finely punctured, shining; scutellum triangular; elytra slightly wider at the base than the thorax, extremely closely but scarcely more strongly punctured than the latter, the interstices minutely wrinkled, the apex nearly impunctate; below and the legs fuscous or black, shining, finely pubescent; abdomen fulvous.

Hab. Salisbury, Mashonaland, Estcourt, Natal (*G. Marshall*).

Of the specimen which I consider a variety and which was obtained at Natal, I have only a single example before me; structurally it does not seem to differ from the type, but it diverges entirely in coloration. The whole under surface is black, the head has two bright fulvous spots at the vertex, the thorax is piceous, narrowly margined with fulvous, and the elytra show the same colour at the base and the apex. Possibly the specimen represents another species.

HEMIXANTHA TERMINATA, sp. n. (Plate XXI. fig. 6.)

Rufous, the antennæ, tibiæ, and tarsi flavous; thorax very finely punctured; elytra black, the apex rufous, punctured like the thorax.

Length 6 millim.

Head rufous, not perceptibly punctured, the eyes very large and prominent, the frontal elevations broad and subquadrate, clypeus triangularly raised, labrum and palpi flavous; antennæ long and slender, flavous, the terminal joints stained with black at the apex, the last one entirely of this colour; third joint one half longer than the second, the following elongate, slightly curved and finely pubescent; thorax scarcely twice as broad as long, the sides very feebly rounded, very narrowly margined, the angles slightly oblique and thickened, the surface very minutely and remotely punctured, rufous, shining, basal margin slightly sinuate at the middle, narrowly margined; scutellum broad, rufous, longer than broad; elytra wider at the base than the thorax, distinctly depressed near the suture, black, the extreme apex rufous, the surface punctured like the thorax; below and the femora reddish fulvous, the tibiæ and tarsi flavous; the metatarsus of the posterior legs as long as the following three joints together.

Hab. Estcourt, Natal (*G. Marshall*).

HEMIXANTHA BIFASCIATA, sp. n. (Plate XXI. fig. 7.)

Reddish fulvous, the antennæ, tibiæ, and tarsi flavous; thorax extremely finely punctured, flavous or fulvous; elytra nearly impunctate, flavous, a narrow transverse band at the base and another below the middle, black.

Length 6 millim.

Head impunctate, rufous, the frontal elevations broad and subquadrate; eyes large and round; antennæ extending nearly to the middle of the elytra, flavous, the apex of the terminal joint black, all the joints with the exception of the second of nearly equal length; thorax nearly twice as broad as long, the sides rounded, the anterior angles produced, subtuberculiform, the surface only perceptibly punctured when seen under a very strong lens, pale testaceous or fulvous, very shining; scutellum triangular, flavous; elytra not more distinctly punctured than the thorax, flavous, the base with a narrow transverse black band extending to the sides,

a similar band is placed below the middle; below and the femora more or less rufous, tibiæ and tarsi pale.

Hab. Estcourt, Natal (*G. Marshall*).

This well-marked species agrees in all structural characters with the other species of the genus, but differs in the amount of rufous of the thorax and the underside.

MONOCIDA, gen. n.

Body elongate; antennæ filiform, the third joint shorter than the fourth; thorax subquadrate, without depression; elytra much wider at the base than the thorax, their epipleuræ indistinct below the middle; legs slender, all the tibiæ mucronate, the first joint of the posterior tarsi as long as the following two joints together; claws appendiculate, prosternum very narrow and convex; the anterior coxal cavities closed.

Amongst the genera with closed coxal cavities, *Monocida* will find its place near *Monolepta* and *Pseudocrania*; it differs from the first in its general narrowly elongate shape and the subquadrate thorax, which is much narrower at the base than the elytra, also in the much less elongate metatarsus of the posterior legs; from *Pseudocrania* the totally different structure of the head and of the antennæ separates the genus.

MONOCIDA SUTURATA, sp. n.

Elongate, black, the head anteriorly, the basal joints of the antennæ, and the anterior legs flavous; thorax minutely punctate, flavous; elytra finely and closely punctured, flavous, the suture and the sides black.

Length 4 millim.

Head black posteriorly, the vertex very finely granulate and punctured, the frontal tubercles very strongly raised, the anterior portion and the palpi flavous; antennæ extending nearly to the apex of the elytra, slender and filiform, the second joint short, the third twice as long but shorter than the fourth joint, the lower four or five joints more or less flavous, the apical ones fuscous; thorax subquadrate, scarcely broader than long, the sides slightly constricted at the base, the anterior angles in shape of a small tubercle, the surface minutely granulate and finely punctured, flavous; scutellum broader than long, black; elytra broader at the base than the thorax and sculptured similarly, flavous, a sutural rather broad band, narrowed posteriorly, and the sides more narrowly, black or piceous; underside and the four posterior legs black, the others flavous.

Hab. Estcourt, Natal, on acacia trees, December (*G. Marshall*).

PLATYXANTHA FACIALIS, sp. n.

Elongate, testaceous, the terminal joints of the antennæ black, the face very elongate; thorax subquadrate, foveolate and im-

punctate; elytra scarcely perceptibly punctured and obsoletely longitudinally sulcate.

Length 8 millim.

Of elongate, somewhat depressed shape, entirely testaceous; the head very long, transversely grooved between the antennæ, the vertex impunctate, the frontal elevations trigonate; the clypeus subquadrate, broad, depressed at each side, the middle with a longitudinal ridge; eyes rather small, ovate; the antennæ slender, black, the lower two joints flavous, basal joint very elongate and slender, the second very small, the following joints nearly as long as the first one, the last three joints broken off; thorax scarcely broader than long, the sides rather strongly constricted at the base, rounded before the middle, the angles acute, the surface with a shallow depression at each side, entirely impunctate; elytra wider than the thorax at the base, the surface scarcely perceptibly punctured, somewhat uneven, with traces of longitudinal sulci, their epipleuræ very broad, concave, and continued to the apex; legs elongate, the tibiæ unarmed; the anterior coxal cavities closed.

Hab. Cameroons (*Conrad*).

The elongate head of this species agrees far more with the typical form *P. apicalis* Baly, from Sumatra, than any other of the African species at present placed in *Platyxantha*. I received a single specimen from Dr. Kraatz.

PLATYXANTHA LUKUNGUENSIS, sp. n.

Narrow and elongate, metallic blue, the antennæ and legs black, head and thorax purplish, impunctate; thorax with a deep transverse depression; elytra finely and closely punctursd.

Length 5 millim.

Head purplish blue, impunctate, the frontal tubercles strongly raised, transverse; the clypeus deflexed anteriorly, strongly raised in shape of an acute triangular ridge; labrum and palpi black; antennæ longer than the body, very slender, black, all the joints finely pubescent, the fifth and the following two joints curved, each joint articulated at the extreme outer angle of the preceding one; thorax subquadrate, scarcely one-half broader than long, the sides nearly straight, the disc impunctate, metallic bright purplish, with a deep transverse sulcation at the middle; scutellum broad, impunctate; elytra narrow and parallel, metallic blue, finely and closely punctured, the interstices somewhat wrinkled; underside and legs blue, the latter long and slender, pubescent, the tibiæ unarmed, the first joint of the posterior tarsi longer than the following joints together.

Hab. Lukungu, Congo (*C. Haas*). Belgian Museum collection and my own.

A narrowly elongate species with all the characters of the genus, distinguished by the long and slender antennæ and the structure of the intermediate joints, probably peculiar to the male sex only.

PLATYXANTHA LIVINGSTONI, sp. n.

Flavous, the head purplish, impunctate; thorax transversely sulcate, impunctate; elytra metallic blue, extremely minutely punctured.

Mas. Antennæ with the intermediate joints curved.

Length 7 millim.

Head impunctate, metallic purplish, frontal elevations broad, transverse; clypeus acutely raised; palpi swollen, flavous, as well as the labrum; antennæ long and slender, obscure flavous, the second joint very short, moniliform, the third and the following joints very elongate, the fifth, sixth, and seventh curved, the terminal three joints slender and thinner; thorax twice as broad as long, the sides straight at the base, slightly rounded anteriorly, anterior angles slightly produced, posterior acute, the surface transversely sulcate, the sulcus not extending to the sides, entirely impunctate, fulvous; scutellum broad, fulvous; elytra with a slight sub-basal depression, extremely minutely punctured, metallic dark blue, their epipleuræ broad and continued; below and the legs flavous.

Hab. Niger-Benue Expedition.

This species differs in its mode of coloration from any of its African allies. I received a single specimen from Dr. Staudinger and Herr Bang-Haas.

MONOLEPTA MALVERNENSIS, sp. n.

Testaceous, the apical joint of the antennæ dark; head and thorax finely punctured; elytra punctured like the thorax, the punctation very close; a spot on the shoulders and another near the apex piceous.

Length 4 millim.

Head with a few fine punctures, obscure testaceous; the eyes very large; labrum piceous; antennæ extending below the middle of the elytra, testaceous, the apical joint more or less piceous, the second and third joints small, equal; thorax about one-half broader than long, the sides nearly straight, the posterior margin straight, the surface very finely and closely punctured, especially so anteriorly; scutellum piceous; elytra more strongly punctured than the thorax, the punctation consisting of very small and larger punctures, the interstices very finely rugose, a small humeral and a larger subapical spot piceous; below and the legs testaceous; elytral epipleuræ indistinct below the middle; anterior coxal cavities closed; metatarsus of the posterior legs elongate.

Hab. Malvern, Natal (*G. Marshall*).

The number and position of the elytral spots, the colour of the antennæ, that of the elytra and of the underside separate this species from the unicolorous variety of *M. 8-maculata* Jac. and *M. citrinella* Jac.

MONOLOPTA ESTCOURTIANA, sp. n. (Plate XXI. fig. 11.)

Flavous, the vertex of the head and the intermediate joints of

the antennæ piceous; thorax very finely punctured; elytra extremely closely and finely punctured; flavous, a transverse band at the base and another below the middle, as well as the sutural angle at the apex, black; breast black.

Length 5 millim.

Head minutely punctured, flavous, the vertex piceous, eyes very large, frontal tubercles distinct; antennæ slender, the lower four or five joints and the apical one flavous, the others piceous; second and third joints short, equal; thorax twice as broad as long, pale flavous, the sides slightly rounded, the angles not produced, the posterior margin evenly rounded, the surface with a very feeble transverse depression at each side, very finely punctured; scutellum black; elytra widened towards the middle, nearly similarly punctured as the thorax, pale flavous, a broad transverse band at the base, its posterior edge strongly dentate or sinuate, and a narrower band, constricted at the middle, near the apex, black, the extreme sutural angle at the apex likewise, to a small extent, piceous; below and the legs flavous, the breast and the pygidium black; the metatarsus of the posterior legs very long.

Hab. Estcourt, Natal (*G. Marshall*).

This species comes very near *M. bifasciata* Jac., *M. melanogaster* Wied., and three or four other African species, all of which have several elytral black bands; the present insect may, however, be separated by the colour of the head and that of the antennæ, also by the black pygidium. I have seen two specimens sent by Mr. Marshall.

MONOLEPTA KRAATZI, sp. n.

Head, thorax, and the breast black, the abdomen and the legs flavous; thorax finely punctured; elytra flavous, very finely punctured, the margins narrowly black.

Length 5 millim.

Head black, very shining, entirely impunctate, the frontal elevations consisting of a single piece, bounded behind by a shallow transverse groove; labrum black, palpi flavous; antennæ extending below the middle of the elytra, black, the basal five or six joints flavous, the third joint nearly double the length of the second; thorax transverse, twice as broad as long, the sides feebly rounded, narrowly marginate, the surface rather convex, finely and somewhat closely punctured, black, shining, scutellum black; elytra very minutely punctured, flavous, all the margins narrowly black; the breast black; the abdomen and the legs flavous, the metatarsus of the posterior legs very elongate; the anterior coxal cavities closed; pygidium black.

Hab. Cameroons (*Conrad*).

The elytral epipleuræ in this species, of which I have received two specimens from Dr. Kraatz, are extremely narrow below the middle, almost absent; the species may be known by the black head and thorax and the similarly coloured elytral margins.

MONOLEPTA KIRSCHI, sp. n.

Dark violaceous blue, the antennæ and the legs black; thorax impunctate; elytra very finely and closely punctured.

Length 5 millim.

Elongate-ovate, widened posteriorly; the head impunctate, metallic dark blue, the frontal elevations distinct, broad, transverse, labrum black; antennæ extending to about the middle of the elytra, black, the third joint twice as long as the second, but distinctly shorter than the fourth, the last-named and the remaining joints equal; thorax more than twice as broad as long, widened at the middle, the sides strongly deflexed, the lateral margins very slightly rounded, the anterior angles thickened, the posterior margin broadly rounded and produced, the surface impunctate; scutellum triangular, impunctate; elytra convex and widened posteriorly, finely and very closely punctured, dark violaceous, their epipleuræ indistinct below the middle; legs black, long and slender, the metatarsus of the posterior legs longer than half the length of the tibiæ.

Hab. Salisbury, Mashonaland (*G. Marshall*); also Natal.

This *Monolepta* may be known from every other species of the genus by the uniform dark violaceous colour and the long metatarsus of the posterior legs. I have seen four specimens from Salisbury and one from Natal.

MONOLEPTA DIVISA, sp. n.

Rufous; the head anteriorly, the antennæ, thorax, and legs flavous, the base of the head black; thorax finely and closely punctured; elytra of similar sculpture, rufous, the base with a transverse black band.

Length 4–5 millim.

Head impunctate, black at the vertex, the lower portion flavous, labrum piceous; eyes very large; antennæ slender, flavous, the apical joint black, the second and third joints short, nearly equal; thorax more than twice as broad as long, the sides scarcely rounded, the anterior angles thickened, the posterior ones oblique, surface closely punctured, very finely so near the anterior portion; scutellum fulvous; elytra ovate, widened towards the middle, extremely finely and closely punctured, the apex of each broadly rounded, the disc rufous, the base with a transverse black band to the extent of one-fourth the length of the elytra and extending downwards along the sides to near the middle, the epipleuræ indistinct below the middle; the underside and the posterior four legs reddish fulvous, anterior legs flavous.

Hab. Malvern, Natal (*G. Marshall*).

This species could easily be mistaken for *Candezea pectoralis* Jac., as the coloration is nearly identical, but in the latter species the antennæ and legs are black and the head is entirely flavous; there are besides this the continued elytral epipleuræ and a much less transverse thorax. *M. longiuscula* Chap. must be another very closely allied species, so far as the coloration is concerned, but is described as having a black abdomen and obscure flavous elytra

(also having a basal black band); the colour of the antennæ is not given, but only the last joint is mentioned as being black; other detailed particulars in regard to structure are absent. Of the present insect I have seen three or four specimens kindly sent by Mr. Marshall.

MONOLEPTA NIGRO-ORNATA, sp. n. (Plate XXI. fig. 12.)

Rufous; the antennæ (the last two joints excepted) and the tibiæ and tarsi flavous; thorax finely and closely punctured; elytra of similar sculpture, rufous, a broad transverse band at the base and another below the middle black.

Length 5 millim.

Of similar shape and size as the preceding species, also of nearly similar coloration; the head with a few minute punctures, rufous; the antennæ long and slender, flavous, the apical two joints black, the second and third joints small, equal, the fourth as long as the basal one; thorax twice as broad as long, of usual shape, finely and closely punctured, rufous, shining; scutellum rufous; elytra punctured like the thorax, the base with a transverse black band, similar to the preceding species, and another band below the middle of the same width but of rather rounded shape near the suture; below and the femora fulvous, the tibiæ and tarsi flavous.

Hab. Malvern, Natal (*G. Marshall*).

I have received several exactly similarly coloured specimens of this species, which differs, besides the coloration, in the less transversely shaped and rufous, not flavous, thorax.

MONOLEPTA OCTOMACULATA Jac.

Of this *Monolepta* several specimens obtained at Frere, Natal, have been sent by Mr. Marshall, in which the elytra are entirely without spots; they differ in no other way whatever from the type, but may be known by the black vertex of the head and the similarly coloured tarsi and breast.

MONOLEPTA CITRINELLA, sp. n.

Elongate, convex, pale greenish flavous; the head and the breast pale fulvous; antennæ long and slender; thorax and elytra extremely minutely punctured; legs slender.

Length 4–4½ millim.

Head broad, obscure pale fulvous, scarcely perceptibly punctured, the frontal elevations indistinct, the clypeus rather strongly raised between the antennæ; the eyes large and round; antennæ nearly extending to the apex of the elytra, flavous, the terminal two or three joints fuscous at the apex, second and third joints small, equal, the basal and the other joints very elongate and slender; thorax nearly twice as broad as long, the lateral margins perfectly straight, the posterior margin rounded, anterior angles slightly obliquely truncate, the disc microscopically punctured; scutellum pale fulvous; elytra very closely and slightly more distinctly punctured than the thorax, convex, the sutural margin rather

darker, the epipleuræ indistinct below the middle; legs long and slender, entirely flavous, the breast pale fulvous; the last abdominal segment of the male with a broadly rounded median lobe, incised at each side.

Hab. Estcourt, Frere, Natal (*G. Marshall*).

Larger than *M. 8-maculata* Jac. and the variety; the antennæ elongate and slender, the sides of the thorax straight, and the punctuation extremely small; the general coloration and that of the legs a greenish yellow.

LUPERUS (MONOLEPTA) NIGROSUTURALIS Jac.

This species was erroneously placed by me in *Luperus*; a more careful examination has proved to me that the anterior coxal cavities are closed, and that the species must find its place in *Monolepta*; the elytral epipleuræ also are indistinct below the middle.

MONOLEPTA CONRADI, sp. n.

Chestnut-brown, the head, antennæ (the last joint excepted), and the thorax flavous, the last minutely punctured; elytra very minutely and closely punctured.

Length 5 millim.

Head obscure flavous, impunctate, the eyes very large, frontal elevations and the clypeus scarcely defined; antennæ flavous, the terminal joint black, the second and third very small, equal, the others elongate and nearly equal; thorax twice as broad as long, the sides straight, the posterior margin rounded, the surface minutely and rather closely punctured, flavous; scutellum fulvous; elytra broader than the thorax at the base and very convex, their epipleuræ obsolete below the middle, of a dark chestnut-brown colour, shining, the surface very finely and closely punctured; the underside of the same colour, the legs flavous.

Hab. Cameroons (*Conrad*). Collections: that of Dr. Kraatz and my own.

In the distribution of colour this species differs from all of its African congeners with which I am acquainted.

ÆNIDEA COCCINEA, sp. n.

Flavous; thorax reddish fulvous, transversely sulcate, impunctate; elytra extremely finely punctured, coloured like the thorax, with a slight purplish gloss.

Mas. Head deeply excavated, the excavation with an erect central projection; antennæ robust.

Length 9 millim.

Head robust, the vertex fulvous, impunctate, the lower portion flavous, entirely occupied by a deep excavation, with a central long tooth-like projection, the apex of which is truncate; clypeus broad, impunctate; antennæ long, obscure dark flavous, the first and third joints of equal length, very elongate, the second moniliform, the following joints shorter than the third, robust, slightly curved, the terminal two joints more slender; thorax about one-half broader

than long: the sides rounded anteriorly, constricted at the base, the disc deeply transversely sulcate, impunctate, the anterior portion with some minute punctures, the sulcation not extending to the sides; elytra with the basal portion feebly raised, extremely minutely punctured near the suture only, the rest of the surface impunctate; below and the legs flavous, the metatarsus of the posterior legs as long as the following joints together, tibiæ unarmed; anterior coxal cavities closed.

Hab. Lindi, Africa (*Bang-Haas*).

The single male specimen which I received from Herr Bang-Haas with the above locality, which is unknown to me, is of a purplish fulvous or reddish colour above and agrees in the excavate head with many other species of the genus, but the structure of the excavation differs from that of the allied species; the palpi are robust.

MACRIMA AFRICANA, sp. n. (Plate XXI. fig. 9.)

Flavous; the base of the head, the antennæ, and the abdomen black; thorax bifoveolate, impunctate; elytra closely punctured and rugose and sparingly pubescent, metallic blue; legs flavous.

Length 7 millim.

Head flavous, the vertex bluish black, impunctate, the frontal tubercles narrowly transverse, the clypeus depressed at each side; penultimate joint of the palpi thickened, elongate; antennæ long and slender, black, the basal joint flavous below, second very small, third as long as the first joint, the following slightly shorter; thorax subquadrate, one-half broader than long, distinctly narrowed at the base, the angles acute but not prominent; the disc bifoveolate, impunctate, flavous; scutellum black; elytra narrowly elongate, metallic blue, closely punctured and finely rugose, their epipleuræ broad and continued below the middle; legs elongate, flavous, tibiæ mucronate, the first joint of the posterior tarsi longer than the following joints together; claws appendiculate; anterior coxal cavities closed; abdomen black.

Hab. Salisbury, Mashonaland (*G. Marshall*).

This insect agrees almost entirely in coloration with one described by Chapuis as *Xenarthra orphana*, from Abyssinia; but in that species the antennæ are entirely flavous, the tibia are unarmed, and the general size is smaller.

CANDEZEA PUNCTATO-LINEATA, sp. n.

Black, the basal joints of the antennæ and the thorax and legs fulvous; head and thorax impunctate; elytra black, finely punctured in closely approached semiregular rows.

Length 4 millim.

Elongate, narrow and convex in shape; the head blackish, opaque, entirely impunctate, the clypeus flavous; antennæ slender, the basal joint long and curved, the second short, the third twice the length of the second, the remaining joints slightly shorter, the basal five joints flavous, the others piceous; thorax twice as

broad as long near the base, the sides strongly obliquely narrowed in front, nearly straight, the surface entirely impunctate, fulvous; the basal margin with a finely impressed line or groove; scutellum broad, pointed, black; elytra very convex, subcylindrical, black, the apex broadly rounded, the surface with very closely approached rows of fine punctures, which are distinct to the apex; the breast dark fulvous; the abdomen and the pygidium black; legs fulvous, the posterior tibiæ with a very long spine, their metatarsus very elongate.

Hab. Cameroons (*Conrad*).

This species, of which I received specimens from Dr. Kraatz, differs entirely from any of its allies in the character of the elytral punctation.

CANDEZEA SALISBURIENSIS, sp. n.

Rufous, the antennæ and legs flavous; thorax very minutely punctured; elytra more distinctly and very closely punctured, metallic blue, the extreme apex fulvous.

Length 5 millim.

Head with a few fine punctures, rufous, deeply transversely grooved between the antennæ, the clypeus swollen; antennæ rather short, flavous, the second joint short, the third about one-half longer, the fourth and following joints slightly widened and shorter, terminal joint more elongate again; thorax twice as broad as long, the sides oblique, straight, the surface very finely and closely punctured; scutellum fulvous; elytra more strongly punctured than the thorax, the punctuation extremely close, the interstices very finely wrinkled, metallic blue, the extreme apex fulvous, their epipleuræ narrow but distinct below the middle; underside and legs fulvous, tibiæ and tarsi paler or flavous.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Closely allied to *C. nigrocærulea* Jac., likewise from Salisbury, but larger, the antennæ entirely flavous, the elytra of a more decided blue colour and with the apex fulvous. I have seen three specimens of this species.

CANDEZEA DAHLMANI, sp. n.

Obscure testaceous; thorax nearly impunctate, transverse; scutellum black; elytra minutely punctured and finely wrinkled, very narrowly margined with black; breast black.

Length 4–5 millim.

Ovate, slightly widened at the middle, the head impunctate, rather broad, the frontal elevations slightly raised and broad as well as the clypeus; the antennæ extending to about the middle of the elytra, testaceous, the apical joint fuscous, basal joint very long and slender, the second and third short, nearly equal; thorax twice as broad as long, the sides straight, obliquely narrowed, anterior angles slightly thickened, the surface extremely minutely punctured, opaque, obscure testaceous; scutellum black; elytra scarcely more distinctly punctured than the thorax, convex, testaceous, all the

margins narrowly black; their epipleuræ likewise edged with black and the breast entirely of that colour.

Hab. Kurazor, Africa.

Of this species I possess three specimens, of which two are simply labelled "Africa" and the other has the above-given locality, which is unknown to me. I believe I received it from Mr. Bang-Haas. The specimens vary much in size, but the black elytral margins are strongly marked as well as the colour of the breast; the elytral epipleuræ are continued below the middle. Another very closely allied species contained in my collection is the following.

CANDEZEA TENUICORNIS, sp. n.

Pale testaceous, the apical joints of the antennæ fuscous; thorax opaque, impunctate; elytra very finely and closely punctured, testaceous, narrowly margined with black; underside unicolorous.

Length 4 millim.

Head impunctate, testaceous, the frontal elevations narrowly transverse, the clypeus with a distinct central ridge; antennæ long and slender, the third joint twice as long as the second, but nearly one-half shorter than the fourth, the lower six joints flavous, the rest fuscous; thorax nearly twice as broad as long, the sides straight, strongly obliquely narrowed in front, the anterior angles obliquely thickened, the surface impunctate, opaque, or with a few very minute punctures, the disc with a very obsolete transverse depression at the middle; scutellum flavous; elytra very finely and closely punctured, narrowly margined with black, the epipleuræ entirely of that colour; abdomen and the legs testaceous, the breast pale fulvous; all the tibiæ mucronate; metatarsus of the posterior legs elongate.

Hab. Sierra Leone.

In its coloration the present insect almost entirely resembles the preceding one, but the antennæ are much more slender and elongate, the third joint is much longer, and the breast is not black; the general size of the insect is also rather smaller and narrower.

CANDEZEA PECTORALIS, sp. n. (Plate XXI. fig. 10.)

Black; the head, thorax, and abdomen flavous, impunctate; elytra very finely and closely punctured, reddish fulvous, the base with a transverse black band, widened at the suture.

Length 5 millim.

Head flavous, the vertex with a few extremely minute punctures, the frontal elevations trigonate, clypeus thickened, carina acutely raised; labrum black, as well as the palpi; antennæ long and slender, black, the ninth and tenth joints, as well as the apex of the eighth and the base of the terminal joint, flavous, basal joint long and slender, the second half the length of the third, the latter shorter than the fourth joint, the following very elongate and thin; thorax nearly twice as broad as long, the sides constricted at the base, rather rounded at the middle, posterior angles oblique, the basal

margin not produced but slightly sinuate at the middle, the disc rather convex, flavous, impunctate and shining or with a few extremely minute punctures; scutellum black; elytra wider at the base than the thorax, convex, very finely and closely punctured, reddish fulvous, the base with a narrow transverse black band, which is widened at the suture and extends to the lateral margins; the breast and legs black; the abdomen flavous, the last segment of the male with a deeply sulcate median lobe, incised at each side.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Distinct in its mode of coloration from any of its allies.

CANDEZEA NIGROTIBIALIS, sp. n.

Flavous, the antennæ (the basal joints excepted) and the tibiæ and tarsi black; thorax obsoletely sulcate, finely punctured; elytra more strongly and very closely punctured.

Length 4 millim.

Head impunctate, the eyes large, the frontal tubercles broad, as well as the clypeus; antennæ long and slender, black, the lower three joints flavous, the second and third joints short, equal in the male, the third joint slightly longer in the female, the other joints very slender and elongate; thorax nearly twice as broad as long, of usual shape, the sides straight at the base, slightly rounded at the middle, the anterior angles slightly thickened, the surface obsoletely transversely sulcate, very minutely punctured; elytra wider at the base than the thorax, distinctly widened towards the middle and convex, extremely closely and more strongly punctured than the thorax, the interstices slightly wrinkled; below and the femora flavous, the breast rather darker; tibiæ and tarsi black, the metatarsus of the posterior legs very elongate, all the tibiæ mucronate; elytral epipleuræ distinctly continued below the middle.

Hab. Malvern, Natal (*G. Marshall*).

Closely allied to *C. femorata* Jac. and *C. mashonana* Jac., but differing from the first in the colour of the antennæ, the differently sculptured thorax, and in the flavous not black scutellum: *C. mashonana* is a larger insect, the thorax is without a sulcus, and the elytra are more finely punctured; *C. flaveola* Gerst. has entirely flavous legs.

EXPLANATION OF PLATE XXI.

Fig. 1. *Œdionychis rugicollis*, p. 342.
2. *Malvernia varicornis*, p. 347.
3. *Malacosoma apicipenne*, p. 362.
4. *Idacantha weisei*, p. 358.
5. *Asbecesta marginata*, p. 359.
6. *Hemixantha terminata*, p. 369.
7. „ *bifasciata*, p. 369.
8. „ *natalensis*, p. 367.
9. *Macrima africana*, p. 377.
10. *Candezea pectoralis*, p. 379.
11. *Monolepta estcourtiana*, p. 372.
12. „ *nigro-ornata*, p. 375.

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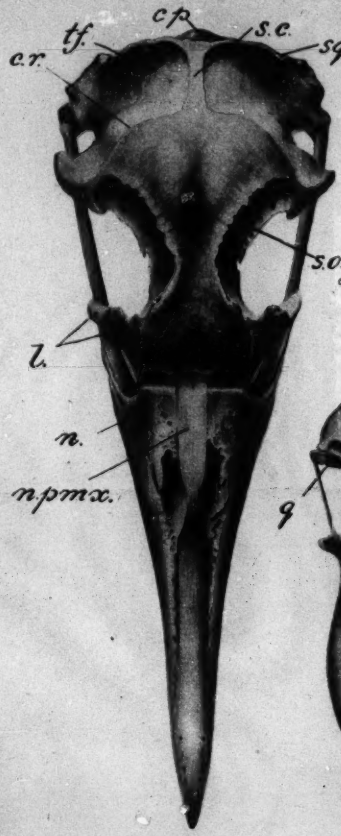


Fig. 1.

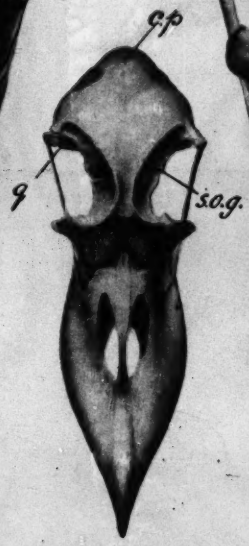
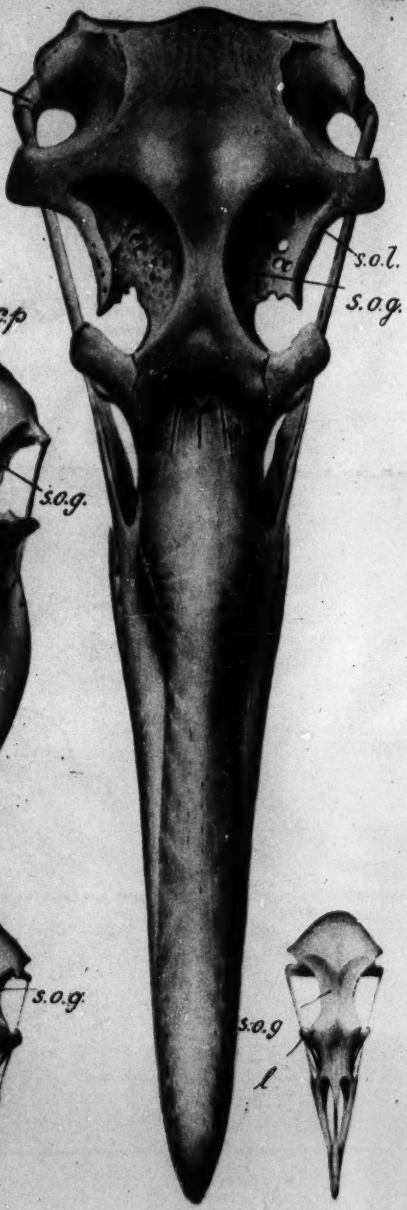


Fig. 2.



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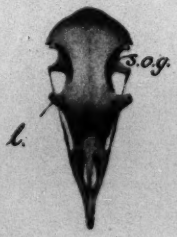

Fig. 3.

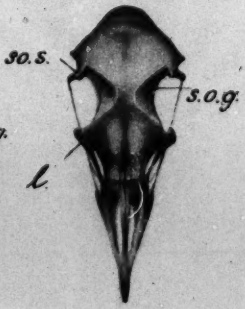

Fig. 4.

Fig. 6.

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OSTEOLOGY OF THE TUBINARES.

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Fig. 1.

Fig. 2.

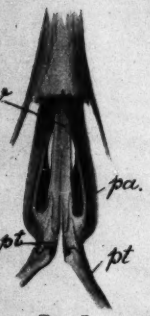


Fig. 3.

Fig. 4.

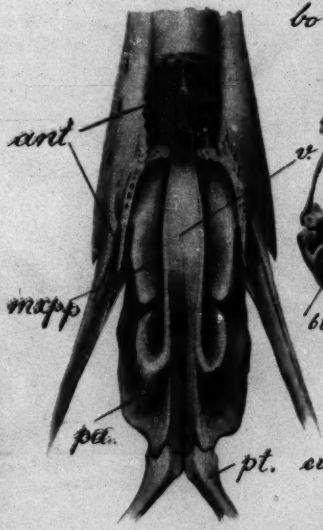
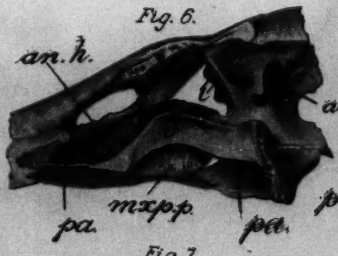


Fig. 5.

Fig. 6.



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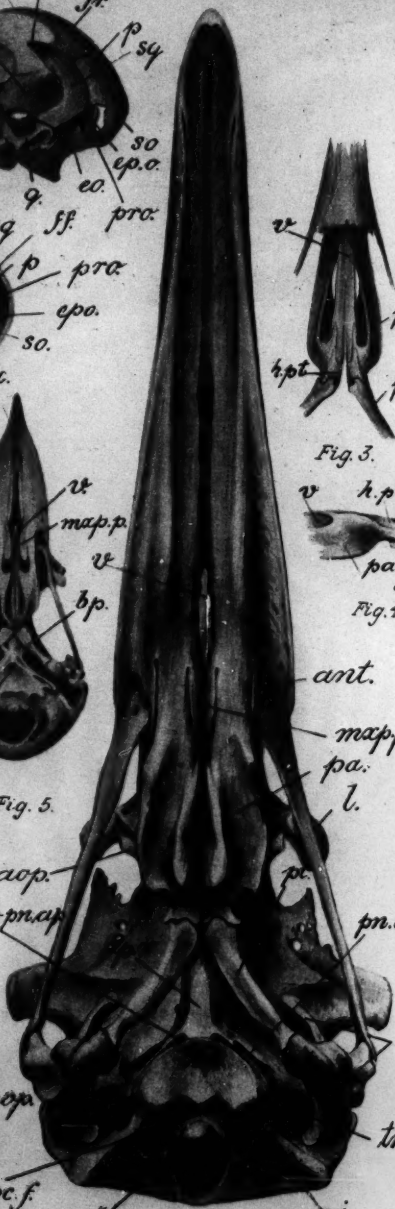

Fig. 8.

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OSTEOLOGY OF THE TUBINARES.

March 21, 1899.

W. T. Blanford, Esq., LL.D., F.R.S., Vice-President, in the Chair.

Mr. E. T. Newton, F.R.S., exhibited some specimens of his *Mus abbotti* and made the following remarks:—"Among the fossil remains of small rodents found in the ossiferous fissure at Ightham, Kent, and described in 1894 (Quart. Journ. Geol. Soc. vol. 50. p. 188), were a few rami of mice resembling those of *Mus sylvaticus*, but wanting the characteristic front tubercle of the anterior lower cheek-tooth. This fossil form was named *M. abbotti*, after Mr. Lewis Abbott, whose zeal in working out the fissure had brought to light these and many other interesting fossil remains. Mr. Barrett-Hamilton has called my attention to the fact that Mr. Waterhouse had previously used the name of *Mus abbotti* for a mouse from Trebizond (Proc. Zool. Soc. 1880, p. 61). I regret my oversight, and avail myself of the opportunity, so courteously afforded me, of rectifying the error. It is proposed to name the fossil mouse *Mus lewisi*, so that it may still be associated with its energetic discoverer."

A communication was read from Dr. G. Stewardson Brady, C.M.Z.S., containing an account of the Copepoda collected, chiefly by means of the surface-net, by Mr. G. M. Thomson, of Dunedin, and by Mr. H. Suter, on behalf of the Zoological Museum of Copenhagen. It was shown that several species were identical with well-known European forms, and others closely allied, but that many were entirely distinct and presented very interesting peculiarities.

This paper will be published in full in the Society's 'Transactions.'

The following papers were read:—

1. Contributions to the Osteology of Birds. Part III. *Tubinares*. By W. P. Pycraft, A.L.S.[1]

[Received February 7, 1899.]

(Plates XXII. & XXIII.)

Contents.

i. Introductory Remarks, p. 381.
ii. The Skull of the Adult, p. 382.
iii. The Skull of the Nestling, p. 393.
iv. The Vertebral Column, p. 397.
v. The Ribs, p. 398.
vi. The Sternum and Pectoral Girdle, p. 398.
vii. The Pelvic Girdle, p. 399.
viii. The Pectoral Limb, p. 400.
ix. The Pelvic Limb, p. 401.
x. Results, p. 401.
xi. Key to the Osteology of the Tubinares, p. 403.
xii. List of Works referred to or consulted, p. 410.
Explanation of the Plates, 410.

i. Introductory Remarks.

Not a little has already been written on the Osteology of the

Tubinares in the very valuable memoirs of Milne-Edwards (14), Brandt (3), Huxley (12), Forbes (5–6), Gadow (8–9), Lydekker (13), and others. Nevertheless, in working carefully through the collection of skeletons of this group in the British Museum, I found that much yet remained to be done, in the way of bringing these facts together, so that, carefully sorted, they might be brought yet more fully to bear upon the question of the systematic position of the group. In this I think I have had a fair measure of success. Besides also I have been enabled to add, here and there, a few original observations.

Following the plan of my last paper, I propose first of all to deal with (ii.) the Adult Skull, then with that of (iii.) the Nestling, following this with (iv., v.) the Axial Skeleton, (vi.) the Sternum and Pectoral Girdle, (vii.) the Pelvic Girdle, (viii.) the Pectoral Limb, and (ix.) the Pelvic Limb.

ii. The Skull of the Adult.

The skull of the Petrels, like that of the Impennes and Colymbi, is schizognathous, holorhinal, and marked by deep supraorbital grooves; but it can at once be distinguished therefrom by its large, laterally expanded vomer fused posteriorly with the palatines, an olfactory cavity of great size—except in *Pelecanoides* and *Puffinus assimilis*,—and the markedly hooked upper jaw. The mandible retains a distinct dentary suture and coronoid, the free end of which last terminates in a more or less heart-shaped expansion. The angulare is truncated, and the internal angular process is small.

The Occipital Region.—The dorsal border of the supra-occipital region in the Procellariidæ is strongly arched; in the Diomedeidæ the curve of this border is very slight. The curve is produced downwards on either side into the paroccipital processes, which project, or rather depend, from the skull in the form of conical "bosses." The aperture of the foramen magnum varies in form and size. The occipital condyle is sessile, save in *Diomedea exulans*, in which it is produced backwards on a stout base so as to project considerably behind the foramen. In certain genera—e. g., *Thalassœca*, *Daption*, *Œstrelata*, *Prion*, *Priocella*, some species of *Puffinus*, *Oceanites*, *Cymodroma*, *Pelagodroma*, and *Procellaria*—the supra-occipital presents the concavo-convex form so characteristic of the *Sphenisci*. In other forms this swelling is hardly perceptible.

The Roof of the Cranium.—The fronto-parietal region is more or less furrowed in the median line, thus indicating the position of the pallial cerebral fissure; similarly, in many cases—*Thalassœca*, *Priofinus*, *Œstrelata*, *Puffinus*—the cerebellar prominence is transversely ridged, the ridges corresponding to the underlying sulci of the cerebellum. The temporal fossæ vary much in the extent of their development. In *Priofinus*, *Fulmarus*, *Majaqueus*, *Ossifraga*, and many species of *Œstrelata* and *Puffinus* they rise dorsally so as to be divided only by a narrow median

sagittal crest; in others this crest is very broad. In *Procellaria*, *Pelagodroma*, *Oceanites*, and *Cymodroma* these fossæ can hardly be said to exist.

The interorbital region of the frontals is, like the region posteriorly, gently furrowed and moderately wide. This feature, however, does not obtain throughout the group, but varies according to the form and depth of the supra-orbital grooves on either side. Thus in *Procellaria* the interorbital region is very broad, relatively broader than in any other Petrel. In this case the supra-orbital grooves look outwards and not upwards as usual, being only narrow and shallow depressions scooped out of the free edge of the frontal. In *Cymodroma* these grooves are very short antero-posteriorly, their length being less than the width across the frontals between the lachrymals. This occurs in no other Petrel. In *Oceanites* and *Pelagodroma* the grooves of either side are practically confluent, reducing the interorbital region to a faint and barely perceptible ridge. The grooves are wider posteriorly than in any other forms, crossing the skull almost transversely in this region. In *Pelecanoides*, *Priocella*, and *Phœbetria* the grooves are divided by a high, narrow ridge, which in *Priofinus* becomes wide enough to permit the existence of the median groove previously referred to, whilst in *Pelecanoides* it has acquired a knife-like edge. In none of the Procellariidæ is there ever any pronounced supra-orbital ledge such as obtains in the Penguins. In some, as in *Priocella*, this is feebly developed, but it is never conspicuous. In the Diomedeidæ the case is otherwise. In this group, and especially in *Diomedea exulans*, it may be as well developed as in *Catarrhactes* amongst the Penguins, and, as in this genus and that of *Pygoscelis*, the free edge of this ledge is greatly flattened.

The Base of the Skull.—The typical Procellarian form of the basitemporal plate of the parasphenoid is triangular, with a free anterior border. From this it follows that the Eustachian passages are represented by grooves intead of tubes. In *Procellaria*, *Oceanites*, *Cymodroma*, *Pelagodroma*, *Bulweria* (occasionally), *Puffinus* (*P. kuhli*), and *Pelecanoides* a tube is more or less perfectly formed, by the downgrowth of a thin plate of bone from the alisphenoidal wings of the parasphenoid. In all the Procellariidæ except *Pelecanoides* there is a more or less conspicuous aperture, receiving numerous pneumatic foramina, opening downwards immediately above the pneumatic grooves, to the inner side and a little in front of the articular surface of the quadrate. This aperture is in some cases of very considerable size, e. g. *Fulmarus glacialis*: a probe passed down it, in a forward direction, leads into the parasphenoidal rostrum. In the Diomedeidæ this aperture is smaller and opens directly backwards rather than downwards; furthermore, it is situated much nearer the middle line than in the Procellariidæ, inasmuch as it does not pass the level of a line drawn through the mammillary processes, whilst in the latter, as just stated, it opens near the quadrate articular surface. In

Diomedea exulans, in addition to the aperture just described, there is a second, opening immediately into the Eustachian groove. This takes the form of a deep cleft lying on either side of the rostrum. In other species of this genus and in *Thalassogeron* and *Phœbetria* the Eustachian groove is shallower and wider, and does not receive pneumatic apertures.

The *basitemporal plate* of *Pelecanoides* differs markedly from that of all the rest of the group, in that it extends the whole width of the base of the skull lying between the quadrates. In all the other Petrels the angles of the triangular base are widely distant from the quadrate on either side. Pneumatic apertures such as those just described are wanting.

Mammillary processes occur only in *Ossifraga* amongst the Procellariidæ and in the Diomedeidæ. In other members of the group the place which these occupy is indicated by a slight protuberance which is continued inwards to meet its fellow of the opposite side in the form of a low ridge. In *Diomedea*, *Thalassogeron*, and *Ossifraga* is a well-marked tubercle lying between the mammillary processes. This is absent in *Phœbetria*. A deep hollow—the paroccipital notch—divides the mammillary from the paroccipital processes, which are moderately well developed, pneumatic, and with a sharp free edge. In the smaller Petrels, e. g. *Oceanites*, *Pelagodroma*, the outline of the basitemporal plate is continued directly backwards into these processes, there is no hollowing out at its base as in the larger species. A precondylar fossa is present in all, but is especially well-marked in the larger forms.

The *parasphenoidal rostrum* is of uniform calibre throughout and terminates anteriorly in the form of a spine extending up to, or beyond, the level of the mesethmoid. It may or may not support basipterygoid processes. These are largest in *Ossifraga*. In *Fulmarus*, *Priocella*, *Daption*, *Pelecanoides*, and *Œstrelata* they are still very distinct. In *Puffinus* they vary in size, from distinct processes to mere vestiges. In *Procellaria* and *Cymodroma* they are represented by minute prickles. In *Pelagodroma* and *Oceanites* and the Diomedeidæ they are wanting entirely.

The Lateral Aspect of the Cranium.—The tympanic cavity is in the dried skull represented by a small, shallow cavity bounded in front by the pneumatic aperture opening near the quadrate articular surface, above by the overhanging articular surface for the otic head of the quadrate, behind by the paroccipital process, and below by the mammillary process (when this is present). The *fenestra ovale* and the *fenestra rotunda* pierce the wall of this cavity, opening immediately within its mouth; behind and above these apertures is the mouth of a large pneumatic cavity leading upwards between the supra-occipital and the proötic bones.

The *temporalis recess* is a large tubular cavity opening forwards above the articulation of the quadrate; it runs upwards under the temporal fossa to terminate near the middle line, in the region of the lambdoidal ridge. This recess is very small in *Daption*,

Bulweria, *Pelecanoides*, and the small Petrels, e. g. *Oceanites*, *Procellaria*, *Cymodroma*.

The *squamosal prominence* (see p. 394) forms the roof and external boundary of the mouth of the temporalis recess, and affords an articular surface for the squamosal head of the quadrate. The paroccipital process (p. 394) is largest in the larger forms; its outer free border runs upwards and forwards to join the squamosal prominence, forming therewith a sharply truncated outstanding process of the skull. Its inner free border can be more or less easily traced running inwards and somewhat forward to the base of the mammillary process of the region representing this.

The *temporal fossæ*.—In all the Procellariidæ the temporal fossæ, when present, take the form of conical depressions, more or less deep, rising obliquely upwards and backwards from the postorbital and squamosal region, which may be taken to form the base of the cone to the sagittal crest in the mid-dorsal line. By means of this fossa the outline of the cerebral and cerebellar regions of the brain are plainly indicated. This is particularly well marked in the case of *Priofinus*, and scarcely less so in that of some species of *Œstrelata* and *Puffinus*. Thus, this region of the skull comes to bear a close resemblance to that of the Penguins. It differs therefrom, however, in the more oblique position of the fossa and the more backward position of the squamoso-parietal wings.

In the Diomedeidæ the temporal fossæ differ conspicuously from those of the Procellariidæ, for, instead of taking the form of more or less deep grooves tending to cut off the cerebral from the cerebellar portions of the skull, they are represented only by shallow depressions, of uniform depth, on either side of the parietal region of the skull, and are only discernible by reason of the low ridge representing the periphery of the attachment of the temporalis muscle.

The *trigeminal foramen* lies in a more or less deep fossa into which opens the mouth of the temporalis recess: it is situated immediately above the mouth of the large pneumatic aperture already described in the Procellariidæ as lying dorsad of the Eustachian grooves. In *Diomedea exulans* there is a second smaller foramen immediately below the trigeminal, but this is a pneumatic orifice.

The *orbits* in the Procellariidæ are only very imperfectly roofed in above. The postorbital process serves to protect the eye from above and behind and the lachrymal in front; the outer border of the nasal gland protects it above. The interorbital septum forming the mesial wall, dividing the two cavities, is perforated. It is bounded antero-internally by the antorbital plate, and postero-internally by the orbito- and alisphenoids. The orbitosphenoid is only very incompletely ossified; thus in the dried skull the orbit is placed in communication with the brain-cavity. In *Cymodroma*, *Oceanites*, *Bulweria*, and *Pelecanoides* the interorbital septum is practically wanting, being represented only by a slender bar of

bone from the dorsal region of the rim of the optic foramen forwards to the interorbital plate.

The *orbitosphenoid* in the Diomedeidæ is completely ossified; the roof of the orbit is more or less perfectly protected by a supra-orbital ledge, such as occurs in the Penguins.

The optic foramina in Diomedeidæ, *Ossifraga*, *Fulmarus*, *Priocella*, *Prion*, *Daption*, *Thalassœca*, and some species of *Puffinus* and *Œstrelata*, are divided by a median septum one from another; in the rest the septum is absent and the two apertures are confluent.

The *ethmoidal region*.—The *mesethmoid* is indistinguishably fused below with the parasphenoidal rostrum, from which it rises as a thin vertical plate of bone, in the median line. Its dorsal border is expanded so as to underlie the nasal and frontal bones, extending outwards on either side to the level of the free edge of the supraorbital groove. The anterior border of the mesethmoid is of considerable width; postero-dorsally it extends backwards to play the part of a crista-galli dividing the *olfactory fossæ* into right and left lateral chambers; its postero-ventral border is merged with the interorbital septum when present. The aliethmoid is only the ectoethmoidal ossification and forms the antorbital plate. This, in the Procellariidæ, is generally of very considerable size. In *Bulweria* it takes the form of an almost vertical plate of bone, projecting nearly at right angles from the posterior border of the mesethmoid, and running outwards to the lachrymal. Its dorsal border becomes continuous with the free edge of the expanded mesethmoid. Its postero-dorsal angle is more or less hollowed out and trends downwards to join the median horizontal bar of bone representing the interorbital septum. This antorbital plate serves to enclose two spacious olfactory chambers divided one from another by the mesethmoid. Anteriorly they are in direct communication with the lachrymo-nasal fossa, posteriorly with the brain-cavity. *Procellaria*, *Oceanites*, and *Cymodroma* more or less resemble *Bulweria* in this respect. In *Fulmarus*, *Thalassœca*, *Œstrelata*, *Daption*, and *Prion* the form of the antorbital plate resembles that just described. In these genera, however, the outer border is fused with the lachrymal. In all the genera so far enumerated the dorsal border of the lachymal is pierced by two foramina. Of these, one lies immediately under the free edge of the frontal, and the other between the lachrymal and the aliethmoidal wall. In *Priocella* these two foramina are merged into one, forming a deep emargination between the dorsal wall of the antorbital plate and the frontal; externally this plate and the lachrymal are fused as in *Fulmarus*, &c. The outer of these two foramina—the lachrymal—in *Priofinus*, *Majaqueus*, and *Puffinus* is of great size; in all except a few species of *Puffinus* the antorbital plate remains distinct from the lachrymal.

In the Diomedeidæ the antorbital plates are represented by a pair of narrow lateral wings, which never extend dorsally to meet the frontal. In *Phœbetria* they extend laterally so as to pass behind, and project slightly beyond, the level of the lachrymal.

The antorbital plate of *Pelecanoides* resembles that of the Diomedeidæ, but is narrower and does not quite reach to the level of the lachrymal.

The *olfactory cavity* is of great size in all the Tubinares except *Pelecanoides* and *Puffinus assimilis*; in these it is reduced to a chamber of comparatively insignificant size.

The *lachrymal* is of very considerable size and more or less T-shaped. It extends from the fronto-nasal region downwards to the quadrato-jugal bar. The stem, anteriorly, is provided with a large lachrymal foramen. In *Œstrelata* and *Thalassœca* the posterior limb is laterally expanded and rises upwards, its free edge looking outwards and backwards. In *Priofinus* this peculiarity is repeated, but in a less marked degree. *Ossifraga*, *Procellaria*, *Oceanites*, *Cymodroma*, *Pelagodroma*, and *Bulweria* all agree in having the anterior limb produced far forwards, so much so that the horizontal exceeds that of the vertical axis, the former being represented by a line traversing the arms, the latter the stem. In *Cymodroma*, *Oceanites*, and *Pelagodroma* there is a wide chink separating the dorsal border of the anterior limb from the fronto-nasal border.

In *Pelecanoides* the anterior and posterior limbs are almost obsolete, the anterior limb is pierced by a large foramen, and the inner, nasal border is notched. The vacuity in the stem of *Puffinus assimilis* is very large.

In the Diomedeidæ the anterior and posterior limbs, as in *Pelecanoides*, are freely developed. In *Diomedea melanophorus* the anterior is wanting. In *Phœbetria* the posterior limb is produced outwards, backwards, and upwards more than in any other member of the order.

The lachrymal is ankylosed with the nasal in *Ossifraga*, *Fulmarus*, *Daption*, *Prion*, *Thalassœca*, *Œstrelata*, and *Priocella*.

The *ossiculum lachrymo-palatinum*, or "os crochu," is best developed in the Diomedeidæ. In *Diomedea exulans* it is a styliform bone, the upper half of which is of a more or less triangular spatulate form; the lower is cylindrical. Seen *in situ*, from in front, the inner border is concave, the outer triangular. It articulates above with a process from the inner border of the lachrymal, by means of its laterally compressed dorsal extremity, and below by a ligament to the outer border of the palatine. In *Thalassœca*, *Prion*, *Bulweria*, and *Priofinus* it is represented by a small slender rod, which in the first-mentioned is almost hair-like in thickness. In both it depends from the distal end of the lachrymal below its junction with the antorbital plate, and extends downwards towards the palatine, with which, doubtless, in life it is connected by ligament. In all the other specimens under my charge it is wanting. The late W. A. Forbes (6) gives a brief survey of this bonelet and its relations to the various surrounding parts. In many cases it is represented only by a vestigial nodule imbedded in ligament. It occurs also, according to Forbes, in the "Musophagidæ, many Cuculidæ, *Chunga*, and *Cariama*, as well as

in some Laridæ and Alcidæ, so that its presence is obviously of no particular taxonomic value." Brandt (3) and Rheinhardt (17) have made numerous and careful observations concerning this bone.

The Cranial Cavity.—The *metencephalic fossa* takes the form of a moderately deep basin with gently sloping sides. It is steepest in front, where it rises to terminate at the dorsum sellæ. In the posterior region, just behind and below the internal auditory meatus, lies the large vagus foramen, and further back, near the outer border of the occipital condyle, is the condyloid foramen. In the anterior region, near what one might call the "rim" of this basin, on a level with the floor of the *pituitary fossa* and to its outer side, lies the *abducent foramen*.

The *cerebellar fossa* is bounded by the supraoccipital behind, the parietal above, and the proötics below. In the Procellariidæ the parietal portion is deeply corrugated, the ridges running transversely. These represent the sulci, and the corresponding depression the positions of the gyri. This feature is less marked in the Diomedeidæ; moreover, in the latter this fossa can be more or less distinctly divided into a median and two lateral regions, the latter lying above and in front of the proötics.

The *mesencephalic fossa* lies in the alisphenoid and is moderately deep; its superior external boundary is formed by the tentorial ridge; its ventri-lateral border is pierced in the Procellariidæ by the trigeminal foramen and the foramen for a branch of the *vena cephalica posterior*. The former is the lower and opens externally just inside the ventral border of the mouth of the temporalis recess: the latter lies immediately above this and opens inside this recess. In the Diomedeidæ these two foramina may have a common aperture which lies in a depression below that of, and leading into, the temporalis recess.

The *pituitary fossa* is very deep and slopes obliquely backwards. The *dorsum sellæ* overhangs it posteriorly, whilst the *perpituitary ridge* bounds it in front; this last is more or less flattened so as to form an optic platform—representing the inferior border of the *optic foramen*. Similarly, the upper boundary of the optic platform is formed by a pre-optic ridge, which passes on either side into the tentorial ridge.

The *optic foramen* appears as a single aperture in many Procellariidæ; in the rest, and in the Diomedeidæ, it is more or less completely divided into a right and left aperture by means of the interorbital septum.

The *cerebral fossæ* lie entirely in front of the cerebellar fossa, from which they are separated by a well-defined tentorial ridge. This may be traced from the pre-optic platform outwards, backwards, and upwards to a point in the middle line, immediately above the centre of the floor of the metencephalic fossa, where it joins that of the other side. From the point of this junction there runs forwards, in the median line, a prominent ridge, the bony falx, which is continued forwards to the crista-galli, and marks the

division of the hemispheres dorsally. The cerebral fossa is of much greater relative size in the Diomedeidæ.

The *olfactory fossæ* are paired tubular cavities lying immediately in front of the cerebral fossæ, and leading out into the olfactory chamber by a wide aperture.

The Premaxilla.

The *premaxilla*—and, as will be shown presently, the whole facial skeleton—closely resembles that of the Ciconiiformes.

In the Tubinares it is in all cases more or less produced forwards and strongly hooked at the tip. In breadth it varies. In the Procellariidæ, amongst the smaller forms, e. g. *Oceanites*, what is probably the more primitive form of this region of the skull obtains, in that we can distinguish the three radiating prongs by which the premaxilla is bound to the rest of the jaw, viz., the median, paired, nasal processes and the lateral maxillary processes. In *Oceanites*, *Cymodroma*, &c. these are long and narrow and wide apart. Thus we get a long, median palatal vacuity, and elongated, paired, but horizontal and pervious nares. The nasal processes fuse proximately with the nasal bones and are never more than indistinctly to be made out in this region. The outer border of the maxillary processes in the larger Procellariidæ, e. g, *Fulmarus*, *Priofinus*—aided by the maxilla—take the form of vertically flattened plates, which in *Prion* become laterally expanded so as to make the beak boat-shaped—as in *Balæniceps* and *Cancroma* amongst the Ciconiiformes. The great development of these vertical plates causes the narial apertures to look upwards, rather than outwards as is usual. Moreover, it gives the jaw the appearance of great solidity, which attains its climax in the Diomedeidæ.

In all belonging to this subfamily—save the genus *Puffinus*—as already indicated, there is a large vacuity immediately distad of the maxillo-palatine processes and extending forwards to the tip of the jaw. In the genus just referred to as the exception to this rule, the vacuity is represented by a wide chink, not extending forwards further than the middle of the jaw, where the edges of the crevice meet to form a bony roof to this region of the mouth. There is an approach to this condition in *Priofinus* and *Majaqueus*. The palatal surface of the maxillary processes attains its maximum breadth in *Prion* and *Pelecanoides*. In the Diomedeidæ this premaxillary vacuity is reduced to a long narrow chink extending about as far as the middle of the jaw, when, as in *Puffinus*, the edges meet to form a bony palatal roof.

The Maxillo-jugal Arch.

As in the Ciconiiformes, the *maxilla*, in the adult, is indistinguishably fused with the premaxilla. The maxillo-palatine processes, in *Oceanites*, *Cymodroma*, and *Procellaria*, are represented by delicate horizontal, more or less fenestrated, leaf-shaped expansions approaching one another in the middle line. In the rest of the

Procellariidæ they are unfenestrated, and somewhat resemble those of the Laridæ in that they take the form of flattened lamellæ. They differ at once from the Gulls, however, in that they are never markedly concavo-convex, and never extend backwards into the lachrymo-nasal fossa. Furthermore, they differ in that they are hollowed out to form the large *antrum of Highmore*, which is provided with both anterior and posterior apertures. On the palatal surface they may appear, as in the Gulls, in the middle line, between the palatines, as short, somewhat scroll-like processes; whilst in others, e. g. *Priofinus*, they are quite concealed by the palatines.

In the Diomedeidæ the *maxillo-palatines* and the *antrum* attain a considerable size. The inner wall is an unfenestrated, vertical, concavo-convex lamella, projecting far back into the lachrymo-nasal fossa. It extends from the level of the posterior narial aperture downwards so as to depend in the median line, considerably below the level of the tomium—as in the Storks; then turns outwards and upwards to the tomium to contribute towards the formation of the palatal roof. In this ventral portion is embedded the distal end of the palatine. The *antrum* contains a little cancellated tissue. It opens posteriorly by three apertures—a median and inner, and two lateral; the former, in *Diomedea exulans*, extends the whole height of the *antrum*. In *Phœbetria* the corresponding aperture is very small. The share contributed by the maxilla to the quadrato-jugal arch cannot be very well made out in the adult, owing to the completeness of the fusion of the different elements.

The anterior end of the quadrato-jugal arch, in *Oceanites*, *Cymodroma*, *Procellaria*, *Pelagodroma*, *Bulweria*, and *Ossifraga*, by a slightly upward direction more or less reduces the size of the lachrymo-nasal fossa, giving it the form, in *Oceanites* for instance, of a wide chink. In all but *Pelecanoides* the lachrymal articulates with the quadrato-jugal bar. In *Ossifraga* this is brought about by means of a triangular bony process arising from the distal end of the jugal.

The Vomer, Palatine, and Pterygoid.

The *vomer*, like that of the Ciconiiformes and Anseriformes, is ankylosed with the palatines. In *Oceanites*, *Cymodroma*, *Pelagodroma*, and *Procellaria* it resembles that of *Phaeton* (a Steganopode), in that it is cleft in the middle line from behind forwards for the greater part of its length, the two resultant laminæ being turned slightly outwards. Thus, from below, the vomer appears as a tongue-shaped ossification, cleft for about half its length, from behind forwards, and terminating in a more or less decurved point. In *Pelecanoides* it is somewhat constricted caudad. In the remaining genera of the subfamily Procellariidæ the vomer is very broad and hastate in form, the sides are raised dorsally, and in *Majaqueus*, *Fulmarus*, *Thalassœca*, *Priocella*, and *Ossifraga* there is a more or less well-marked median dorsal ridge. The tip is more or less pointed and decurved. In *Ossifraga* the vomer, seen from

below, presents an elongated tumid swelling immediately behind the maxillo-palatine process; immediately in front of this it rises suddenly dorsalwards, and curving forwards above the maxillo-palatine descends to the level of the palatines, between their extreme anterior ends, in the form of a long spine-like process. A median keel traverses the ventral surface from the region of the tumid swelling forwards.

The vomer of the Diomedeidæ is peculiar in that, though dorso-ventrally depressed, its edges are not upturned; in that, about the middle of its length, it turns abruptly downwards, and then, at its tip, forwards. Furthermore, the ventral surface bears a deep median keel (Pl. XXIII. fig. 7). Seen from below, with the surrounding parts *in situ*, the vomer is discovered as a thin blade—the ventral keel—lying at the bottom of a deep, narrow cleft, formed by the palatines and maxillo-palatine processes. Immediately anterior to these last lies a short rod—the tip of the vomer (Pl. XXIII. fig. 8). The posterior dorsal surface of the vomer underlies the anterior end of the parasphenoidal rostrum. The junction of the vomer with the palatines is indicated by a notch on its posterior dorsal border.

The *palatine* in its general form, and in the nature of its junction with the vomer, agrees very closely with that of the Storks and Herons. Seen ventrally, and traced from before backwards, the anterior end is strap-shaped and underlies the maxillo-palatine process; more or less distant from the posterior free border of this, its inner border develops a strong keel, whilst the corresponding region of the outer border produces a similar, but smaller keel. Both terminate a short distance in front of the pterygoid articulation, the palatine in this region becoming suddenly rod-shaped. Dorsally, traced from the pterygoid forward, the palatine is more or less laterally compressed into a blade-like ridge, which, nearing the vomer, gives off from its outer border a thin, concavo-convex scroll of bone which runs gracefully forwards to terminate immediately behind the posterior maxillo-palatine border: meanwhile the main body of the palatine runs forwards to become almost, if not quite, indistinguishably fused with the vomer. The scroll-like plate just mentioned, seen laterally, often forms a high vertical crest—e. g., *Puffinus*, *Diomedea*.

In *Bulweria* the inner ventral keel is feebly developed, and the outer border rises upwards, scroll-wise, giving the whole palatine a tumid inflated appearance. In *Oceanites* and its near allies the ventral ridges of the palatine are but feebly developed. In *Ossifraga* the inner keel of the ventral surface is triangular. The palatine is pneumatic, the foramina opening at the foot of the dorsal crest.

The *pterygoid* in *Procellaria*, *Cymodroma*, *Oceanites*, and *Pelagodroma* is rod-shaped, without basipterygoidal facets or pneumatic apertures. *Pelecanoides* and *Bulweria* have also non-pneumatic pterygoids. The pterygoid of the remainder of the Procellariidæ is more or less rod-shaped and carved into a strong dorsal crest.

In *Prion* there is a tendency towards a distal expansion of the pterygoid, so marked a feature in the Sphenisci. Ill-defined basipterygoidal facets can be traced on the inner border just behind the point where the shaft rests upon the parasphenoidal rostrum; just within the inner border of the quadrate articular end is a small pneumatic foramen.

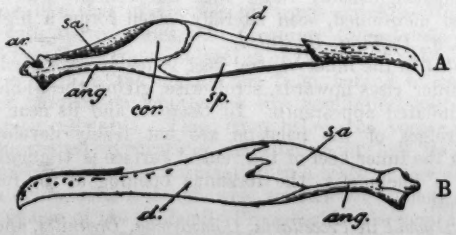
In the Diomedeidæ the pterygoids are relatively longer than in the Procellariidæ, they bear no trace of basipterygoidal facets, are quite rod-shaped, and rest upon the parasphenoidal rostrum only by the inner border of their extreme distal ends. The posterior pneumatic foramen is very large. In *Thalassogeron* the extreme distal end rises, upwards, above the pterygoidal articulation to embrace the rostrum. In *Diomedea exulans* only does there seem to be a total absence of a dorsal crest.

The *quadrate* differs from that of the Storks mainly in the disposition of the mandibular articular surfaces, in the absence of a pneumatic foramen between the posterior surfaces of the otic and squamosal articular surfaces, and the less marked division between the dorsal aspects of these two processes. The dorsal border is slightly hollowed; the orbital process large and expanded. The mandibular articular surface is very broad, runs at right angles to the long axis of the skull, and projects inwards considerably beyond the base of the orbital process. There is a very distinct head for articulation with the pterygoid. The outer mandibular condyle is marked by a strong median transverse depression, slopes obliquely backwards, and is separated by a wide groove from the inner, which takes the form of two grooves divided by a median ridge. The quadrato-jugal glenoid cavity lies in the outstanding process at the base of the outer side of the otic process.

The Mandible.

As in the Penguins, Storks, and Herons, the dentary suture and the spatulate free end of the coronoid (fig. 1) remain distinct through-

Fig. 1.



Inner (A) and outer (B) views of the lower jaw of a nestling *Oceanodroma leucorrhoa*.

ang., angulare; *ar.*, articulare; *d.*, dentary; *cor.*, coronoid; *s.a.*, supra-angular *sp.*, splenial.

out life. There is a more or less well-marked vacuity over the lower limb of the dentary suture which is closed by the coronoid. In the Procellariidæ there is a more or less well-marked pneumatic foramen opening into the dorsal surface of the internal angular process. In the Diomedeidæ there is a more or less well-marked posterior lateral vacuity which pierces the posterior end of the supra-angular. In *D. exulans*, immediately behind this vacuity, on the inner side of the jaw, is a large pneumatic foramen leading backwards below the glenoid surfaces. Furthermore, in this species there is a deep pit, receiving numerous pneumatic foramina, lying immediately behind the articular surface for the inner condyle of the quadrate. The angular is sharply truncated and the internal angular process is very small.

The Hyoid.

The *hyoid* most nearly resembles that of the Penguins and Storks, particularly the former. There is no osseous basihyal. In one skeleton of *Pelagodroma marina* in the Museum Collection I found a pair of ossified ceratohyals; these were probably also present in many other skeletons, but have been lost in maceration; the basibranchial, seen dorsally, is fan-shaped and more or less conspicuously hollowed. It is produced backwards into a short bony style, from the base of which spring the ceratobranchials. A similar, conical, bony style runs from the anterior border of the fan forwards and at right angles to its long axis. The ceratobranchials are rather more than twice as long as the epibranchials, which are tipped with cartilage.

iii. The Skull of the Nestling.

The sutures of the skull, unlike those of the Struthious birds and the Penguins, close early. But in very young nestlings the separate bones can all be traced. The skulls from which the following descriptions are taken are those of very young nestlings of *Oceanodroma leucorrhoa*.

The Cartilage-bones.

The cartilage-bones are now, for the most part, more or less completely ossified.

The *basioccipital* widens gradually from behind forwards. It is under-floored in front by the basitemporal plate, and bounded on either side by the exoccipitals, from which it is separated by a narrow synchondrosis; behind, it is rounded off to form the median portion of the occipital condyle.

The *exoccipital*.—The upper half of the posterior border of the exoccipital skirts the epiotic; the lower is excavated to form the lateral region of the foramen magnum. The share which it takes in the formation of the occipital condyle is a very small one. Its inner border is yet separated from the basioccipital by a

narrow synchondrosis widening slightly forwards. Its dorsal border is embedded in a mass of cartilage lodging the proötic, and dividing the exoccipital from the squamosal. Its anterior border looks somewhat upwards and outwards, and is continued dorsalwards into the proötic cartilage, whose free edge forms the posterior wall of the tympanic recess. Seen from within, the exoccipital is more or less flabellate anteriorly, with an elongate posterior stem. The inner segment of its convex border abuts against the basioccipital, the outer is bounded by the opisthotic. The stem is bounded on one side by the vagus foramen, on the other by the foramen magnum.

The *supraoccipital* is completely ossified inferiorly and separated from the exoccipital by synchondrosis. Its superior border is as yet very incomplete, deeply concave, with a crenated free edge. Thus a large lambdoidal or parieto-occipital fontanelle is formed. Its dorso-lateral angle joins the parietal, its ventri-lateral the exoccipital, by means of a short, narrow bar; between these two areas is a wide chink, separating the supraoccipital from the epiotic. The groove lying below this chink is scooped out of the thin plate of bone joining the epiotic to the supraoccipital.

The *epiotic*, seen from without, is represented by a subcrescentic tract of bone, bounded along its inner border, above by a wide chink, and below by the upper part of a deep groove from the supraoccipital. The upper end of its outer border is embedded in the proötic cartilage, its lower end is separated by a thin band of cartilage from the exoccipital. Seen from within, it takes the form of a perfectly free semicircular coil bounding the floccular fossa posteriorly. Its upper and lower ends are separated by cartilage from the proötic. It is fused with the supraoccipital by means of a narrow plate of bone extending from the posterior border of its inferior end. (Pl. XXIII. figs. 1, 2.)

The *proötic*, from the outside, appears as a broad oblong tract of cartilage lying between the squamosal and exoccipital. Its free border forms the posterior wall of the tympanic recess, and is continuous with that of the squamosal prominence. It is bounded posteriorly by the epiotic. The floccular fossa, at this stage, lies in this tract of cartilage, in the angle between the squamosal and parietal above, and the exoccipital and epiotic below.

On the inside, it is bounded by the epiotic behind, and the opisthotic below. Between its junction with the epiotic and the opisthotic its border is deeply excavated to form the outer boundary of the floccular fossa. Its supero-lateral border rests upon the lower end of the squamosal, and cuts off this bone from participating in the formation of the brain-case. It is bounded on either side by the parietal (behind) and the alisphenoid (in front); its anterior border is bounded in part by the alisphenoid, and in part by a mass of cartilage lying between this and the basisphenoid, which probably represents tissue into which ossification was destined to spread from the alisphenoid, proötic, and basisphenoid. The

trigeminal foramen lies above the internal and auditory meatus, between the proötic and alisphenoid.

The *opisthotic*, seen from without, is largely cartilaginous. Ossification has, however, begun in the shape of a crescentic nodule of bone lying immediately below the *fenestra ovalis* and above the *vagus foramen*.

Inside it serves to divide the exoccipital and proötic. Ossification has begun from two centres—caudad behind the *vagus foramen*, laterad of the extreme upper end of the exoccipital and at the base of the epiotic; and anteriorly, as a small nodule in the region corresponding with a line continuing the exoccipital suture outwards to the postero-ventral border of the proötic. Both ossifications have fused with the proötic, but remain separate from the exoccipital.

The *basisphenoid* is not visible from without, being concealed by the basitemporal plate. Inside it is bounded, caudad by the basioccipital, laterad by a tract of cartilage which divides it from the alisphenoid, and in the middle line, in front, by the cartilaginous presphenoid. It forms, with the basioccipital, the anterior region of the metencephalic fossa. The pituitary fossa is lodged in its anterior border, and is yet only a shallow depression with an aperture in its posterior border for the internal carotid canal. A mass of diploë divides the basisphenoid from the parasphenoid below.

The *alisphenoid* is more or less quadrate in form—viewed from without. Its outer border is convex and received into the concave border of the squamosal (Pl. XXIII. fig. 1). It is bounded above by the orbital plate of the frontal, below by the lateral wing of the parasphenoid (p. 384) and the trigeminal foramen.

The *orbitosphenoid* is represented only by a sheet of membrane.

The *presphenoid* is still cartilaginous and continuous in front with the mesethmoid.

The *mesethmoid* is a vertical linguiform plate resting upon the distal end of the parasphenoid below and underlying the nasals above. Its posterior border is semicircular, its anterior slopes obliquely backwards and terminates at the free end of the nasal process of the premaxilla.

The olfactory cavity, seen from the inside, after the removal of the mesethmoid, contains a large posterior and an elongated ventral accessory turbinal.

The *quadrate* does not differ materially from that of the adult. The otic and squamosal processes are somewhat less distinctly marked.

The *columella* has well-marked extra- and infrastapedial rays; the suprastapedium is very short.

The *articulare* can still just be distinguished as a separate element (fig. 1, p. 392).

The Membrane-bones.

The *parietal* is trapezoid. Its outer, anterior, and mesial

borders are straight, its posterior border is V-shaped. It does not extend forward beyond the level of the anterior $\frac{1}{3}$ of the vertically elongated squamosal. Its outer posterior border runs from the angle of the lower $\frac{1}{3}$ of the squamosal (Pl. XXIII. fig. 1) inwards to the upper half of the lateral border of the supra-occipital; its inner posterior border is in part approximated to but not yet fused with the supraoccipital, and in part free, bounding, with its fellow of the opposite side, the parieto-occipital fontanelle, as the supraoccipital bounds it ventrally.

The *frontal* is broadest posteriorly. Its mesial and posterior borders are straight. The latter, skirting the parietal posteriorly, sweeps forwards to the inner side of the squamosal, to articulate with the alisphenoid (Pl. XXIII. fig. 1). The free outer border is grooved for the supraorbital gland. The region above the alisphenoid constitutes the orbital plate of the frontal and is of small extent.

The *squamosal* is crescentic in form, the concave border forwards. The tip of the upper limb is free and bounds the supra-orbital groove posteriorly, furnishing the squamosal spines, so conspicuous in the species from which this description is taken, *Pelecanoides* and *Cymodroma*. The lower limb furnishes the squamosal prominence. It is almost entirely excluded from the inner wall of the skull.

The *nasal* is of great size, and conspicuously convex dorsally. It forms the outer roof of the large olfactory cavity. Beneath it lies the horizontal plate of the mesethmoid. Its posterior end is embraced on either side by the frontal. It is deeply notched forwards to form the anterior and external nasal processes. These constitute the posterior boundary of the narial aperture, which is holorhinal.

The *lachrymal* does not differ from that of the adult, p. 387.

The *premaxilla* has fused completely with the maxilla, even in the youngest of the two skulls. The nasal process yet, however, remains distinct.

The *jugal* and *quadrato-jugal* can only be imperfectly distinguished one from another and from the *maxilla*, which differs in no important particular from that of the adult.

The relations between the vomer, palatines, and pterygoid recall those between these elements in *Rhea* (Pl. XXIII. figs. 3, 4).

The *vomer* consists of a pair of elongated, flattened laminæ united in the median line anteriorly. The free posterior ends are received by the concave anterior borders of the hemipterygoids, and are bounded, on either side, by an inwardly turned scroll of bone from the dorsal border of the palatine.

The *palatine* is still free, its anterior end is traceable nearly as far forwards as the tip of the jaw. Posteriorly it develops a strong dorsal keel which eventually turns inwards and forwards to embrace the posterior lateral border of the vomer.

The *pterygoid* is rod-shaped, and continued forwards to articulate with the vomer by means of a large *hemipterygoid*

(Pl. XXIII. figs. 3, 4). This last differs from that of the Impennes, which I described recently (16), in that it is almost quadrate instead of triangular. It is notched at each end. The outer limb of the anterior notch fits into yet another notch formed between the inturned dorsal crest of the palatine and the outer border of the posterior end of the vomer. The posterior notch forms an articular surface for the pterygoid. The palatine runs backward to the pterygoid so as to completely conceal the hemipterygoid from below.

The *dentary*, *angular*, *supra-angular*, *splenial*, and *coronoid* are all still traceable, but fusion of these elements has begun.

iv. The Vertebral Column.

All the presynsacral vertebræ are free, the thoracic are heterocœlous. The cervicals somewhat recall those of the Steganopodes. The odontoid ligament of the atlas is not ossified. The neural arch is deeply notched anteriorly and posteriorly, and meta- and hyperapophyses are more or less well developed. In many the anterior cervicals have a bony bar running forward from the hyperapophysis to the base of the anterior zygapophysis. Neural spines are well developed from the 2nd to the 5th vertebræ.

The hyperapophyses of *Diomedea* are less well developed than in the Procellariidæ.

The thoracic vertebræ in the Procellariidæ bear hypapophyses; these are absent in the Diomedeidæ. The anterior hypapophyses terminate anteriorly in a flattened plate. Below the neural canal the centra of the vertebræ bear each a deep depression, which in some—e. g., *Ossifraga*, *Diomedea*—becomes a large aperture into which open numerous pneumatic foramina. Similarly, in *Ossifraga*, *Diomedea*, and the larger Petrels there are large pneumatic apertures opening above the neural canal and below the transverse processes. The vertebræ of sections A and B of the Procellariidæ are non-pneumatic.

The synsacrum includes some 13 vertebræ. Of these, the 8th or 9th represents the first true sacral and lies behind the acetabulum. Only in a few genera—e. g., *Majaqueus*, *Priofinus*, *Diomedea*—is there any distinct division into anterior and posterior renal fossæ. In many genera, e. g. *Puffinus*, all traces of the original sacral vertebræ are lost. In *Puffinus* the acetabulum lies immediately behind the parapophysis of the last lumbar vertebra; in no other genus do these relations exist, though the one is never far removed from the other.

There are 8 postsynsacral vertebræ (free caudals) including the pygostyle. The intercentra of these vertebræ have been described and figured by Beddard (2). There are 15 cervicals, of which the last 3 or 4 bear free ribs increasing in size from before backwards. The thoracic vertebræ are 7 in number: making a total of 43 in all. In *Fulmarus* and *Daption* the thoracic vertebra next in front of the pre-ilium is fused with the synsacrum.

v. The Ribs.

The cervical ribs are styloid, and in the middle region of the neck are often of considerable length, e. g. *Pelagodroma*, *Puffinus assimilis*. They become very short posteriorly, and finally—on the 3 or 4 vertebræ preceding the thoracic—free. Anteriorly they fuse, above, with a process from below the anterior zygapophysis (diapophysis), below with a ventral lamella running outwards and forwards from the centrum (parapophysis). Thus a canal is formed through which the carotid passes. More or less well-marked catapophyses occur from the 6th to 10th vertebræ. There are 7 pairs of thoracic ribs, all of which, save the last, articulate by means of sternal segments with the sternum. The sternal ribs of the 7th pair are attached by ligament to the posterior border of those next in front. In *Pelecanoides* the thoracic and sternal ribs increase greatly in length from before backwards so as to recall those of the Alcidæ. In *Pelecanoides* and *Diomedea* only are two pairs of thoracic ribs overlapped by the ilium.

Uncinates are present in all but the last one or two pairs. In *Pelecanoides* they are placed in the same horizontal plane and about halfway down the shaft. In all other cases they are seated anteriorly low down, near the distal $\frac{1}{3}$ of the rib and rise backwards to about its middle. They are moderately long and slope obliquely upwards. In all cases they project beyond the rib next behind, and often extend to that succeeding this.

A very useful table showing the number of the vertebræ, ribs, and uncinate processes in the different genera is given in Forbes's memoir (6).

vi. The Sternum and Pectoral Girdle.

The *sternum* assumes two forms—(1) that in which the posterior border is notched, and (2) that in which it is entire. The first includes all the genera except *Pelecanoides*, and the small forms included under sections A and B of the Procellariidæ—e. g., *Procellaria*, *Oceanites*. When the posterior border is notched, the anterior coracoid border is produced forwards far beyond the level of the anterior lateral processes. When the posterior border is entire, the anterior, coracoid border does not project far forwards. *Pelecanoides* belongs to this last division, but can at once be distinguished from the rest by reason of its great length in proportion to its width, in the feeble development of the *spina externa*, and in that the articular surfaces of the sternal ribs are confined to the free edge of the anterior lateral process. In *Oceanites* and *Pelagodroma* there is a large fenestra in the anterior dorsal region of the carina. As will be seen by the appended Key, the various genera which have a notched sternum can only very imperfectly be distinguished one from another.

Pneumatic foramina opening on to the dorsal aspect of the sternum occur in *Majaqueus*, *Priofinus*, *Ossifraga*, and *Diomedea*.

The *coracoid* is of great width across the base. This is especially the case in those genera which have a notched sternum; in these, the shaft is shorter not only in proportion to the width of the base, but also in proportion to the length of the sternum. The width of the base is relatively least in *Pelecanoides*, in which it does not exceed half the length of the shaft, and greatest in *Diomedea*, in which the breadth of the base and the length of the shaft are nearly equal. The procoracoid is large, and there is a supracoracoid foramen. There is no articular facet on the acrocoracoid for the furculum.

The *scapula* is subcylindrical and flattened at its free end, and about as long as the furculum measured from the hypocleideum across to the free end.

The *furculum* is U-shaped, and with, or without, a hypocleideum.

vii. The Pelvic Girdle.

The pelvic girdle of the Petrels most nearly resembles that of the Sphenisci. The resemblance in the case of the Diomedeidæ, however, is less marked, as the pelvis, like the rest of the skeleton in this Family, is more specialized.

In the Procellariidæ, save in *Ossifraga*, the innominate bone remains free throughout life, and the pre-ilia do not meet in the mid-dorsal line above the synsacrum. The pre- and post-ilia are of about equal length. The ischium is produced far backwards and beyond the post-ilium, and turns sharply downwards to join the pubis, with which its free end is firmly united by ligament. The ilio-ischiadic foramen is large; the obturator fissure is very wide and opens forward into the obturator foramen. The innominate of the Penguin differs from that of the Petrel in the smaller size of the ilio-ischiadic foramen, and the shorter and wider ischium. To the increase in the width of the latter the narrowness of the fissure is due.

In *Ossifraga* the innominate is fused with the synsacrum, and the pre-ilia rise forwards to the level of the neural crest of the synsacrum.

In *Pelecanoides* the pre-ilia are reduced to narrow bars of bone articulating with the extreme outer edge of the transverse synsacral ridge, whilst the pubis and ischium are produced directly backwards with a slight downward curve precisely similar to that of the Alcidæ, with which group they also agree in the great length of the posterior thoracic and sternal ribs, thus affording us another instance of the modification of parts by adaptation to similar functions.

In the Diomedeidæ the innominate is not only fused with the synsacrum, but the pre-ilia meet in the mid-dorsal line above its neural crest. The pelvis as a whole, on account of this, comes to resemble that of *Sula*. Other Ciconiiform resemblances have already been pointed out in describing the skull of this family. They suggest a parallel development of characters derived from a common source.

viii. The Pectoral Limb.

The character of the wing is very uniform throughout the group. It is perhaps most nearly comparable to that of the Laridæ. It may be distinguished from that of this last group by the absence of a groove for the deltoideus minor, and in that the 1st phalanx of digit II. is not fenestrated.

The *humerus* in the Procellariidæ has the shaft dorso-ventrally depressed. The free edge of the pectoral crest is triangular, the caput humeri is low and not sharply defined; the tuberculum inferius is large; the sub-trochanteric fossa is of moderate size, is single (not bipartite as in the Gulls), and does not receive pneumatic apertures. The coraco-humeral groove is very shallow. The crista inferius small. The ectepicondylar process is very long. The supracondylar depression for the brachialis inferior is moderately large and deep, but less so than in the *Lari*, in which it forms a very deep pit, saved only from fenestration by a very delicate floor of bone.

The dorso-ventral flattening of the wing is very marked in *Puffinus*, and the supratrochlear depression is shallower than in the more typical humeri, such as those of *Majaqueus* and *Priofinus*. The shaft is almost cylindrical in the smaller Petrels belonging to sections A, B of this paper. The ectepicondylar process is not well developed, and the supratrochlear depression is shallow.

The relative proportions in the length of the arm, forearm, and manus vary considerably amongst the different genera, too much so to be of use for systematic purposes. All the segments appear to be subequal in *Puffinus*, some species of *Œstrelata*, *Priocella*, and *Fulmarus*; the manus is longest of the three in *Thalassœca*, *Puffinus assimilis*, and *Œstrelata neglecta*; it is shortest in *Majaqueus* and *Daption*.

In *Pelecanoides* the pectoral crest is feebly developed, straight and scarcely raised above the level of the shaft. The *crista inferior* is deeply hollowed distad, and the ectepicondylar process and supratrochlear depression are obsolescent.

In the Diomedeidæ—e. g. *D. exulans*—the proximal end of the humerus is squarely truncate. The *tuberculum inferius* widely separated from the *caput humeri*. The *crista inferior* has its free edge swollen into a thick lip immediately before entering the shaft. The subtrochanteric fossa is very small and receives numerous pneumatic foramina. The supratrochlear depression is shallow, inverted-pyriform, and extends some distance up the shaft. The depression proximad of the ulnar condyle is relatively deeper.

The *forearm* can be distinguished from that of the *Lari* by the absence of distinct tubercles for the quills, and the presence of a more or less deep and elongated groove in the inferior aspect of the ulna lying in front of the inferior glenoid cavity.

The *manus* in all cases, save apparently sections A, B of the Procellariinæ, can be distinguished from the *Lari* by the great length of the terminal phalanges.

In *Majaqueus* and *Diomedea exulans*, for instance, the 2nd phalanx of digit II. exceeds that of the 1st. Phalanx i. of digit I. is equal in length to that of phalanx i. digit II. In *Diomedea* again it is rather less instead of equal. In the smaller Petrels the elongation of these phalanges is not so marked.

ix. The Pelvic Limb.

The bones of the pelvic limb are non-pneumatic; the tibio-tarsus is characterized by an enormous flabelliform ectocnemial crest which rises high above the articular surface for the femur: is markedly inflected at its distal end, and provided with an ossified extensor bridge. The fibula does not extend more than $\frac{2}{3}$ the way down the leg, and is much reduced in thickness distally. The tarso-metatarsus has a well-marked intercondylar tubercle. The hypo-tarsus is complex in the Procellariidæ and simple in the Diomedeidæ. The outer and middle toes are of equal length.

In one skeleton of *Diomedea exulans* I find an ossified tarso-metatarsal extensor bridge on the right foot. The hallux is represented by a metatarsal and an ungual phalanx, the latter often of considerable size. In *Pelecanoides* it is absent. The femur, as a rule, is about as long as, or less than, the tarso-metatarsus, and is about half as long as the tibio-tarsus; in *Oceanites*, *Pelagodroma*, *Cymodroma*, and *Procellaria* the femur shortens conspicuously, these measurements being about $\frac{1}{2}$ as long as the tarso-metatarsus and $\frac{1}{3}$ as long as the tibio-tarsus.

x. Results.

Briefly, I think, the outcome of this paper has been to confirm, in a large measure, the conclusions of Forbes as set forth in his most valuable Report on the Petrels collected during the 'Challenger' Expedition (5). The appended diagram (fig. 2, p. 402) is a modification of that published by him in that work. He divided this suborder into two families—Procellariidæ and Oceanitidæ; and two subfamilies—Procellariinæ and Diomedeinæ. *Pelecanoides* he regarded as an aberrant genus of the first mentioned subfamily.

I propose to make two Families—the Procellariidæ and the Diomedeidæ; the former being further divided into two subfamilies—Procellariinæ and Pelecanoidinæ. Thus Forbes's Diomedeinæ becomes raised to the rank of a family, his genus *Pelecanoides* to the rank of a subfamily, whilst his family Oceanitidæ becomes, in my scheme, reduced to a section of the Procellariinæ. The sections in this subfamily are three in number, and can quite conveniently be diagnosed from the characters of the skull alone (see Keys, pp. 403–409).

Pelecanoides forms the second subfamily. In the great width of the basitemporal region of its skull it differs from every other member of the suborder. The sternum and pectoral girdle are

also peculiar, as is the pelvis. If only on account of these differences it must, I think, be allowed to take higher rank than that accorded by Forbes, though they seem scarcely important enough to demand the formation of a separate family as has been done by Salvin (18) for instance.

Fig. 2.

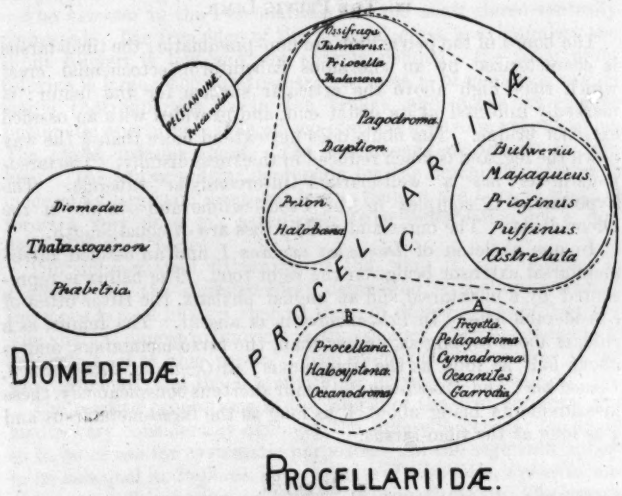


Diagram to indicate the inter-relationships of the Tubinares.

Ossifraga is undoubtedly the most highly specialized of the Procellariinæ. With this genus Forbes has placed *Fulmarus*, *Priocella* (*Thalassœca*), *Thalassœca* (*Aeipetes*), and a little further removed *Pagodroma* and *Daption*. The study of the skeleton seems to confirm the wisdom of this. I cannot, however, express an opinion as to *Pagodroma*, this genus not being represented in the Museum's collection of skeletons. Salvin has associated the genera *Priocella* and *Thalassœca* with the second of Forbes's large groups of genera, containing *Bulweria*, *Majaqueus*, *Priofinus* (*Adamastor*), *Puffinus*, and *Œstrelata*.

Halocyptena, *Pagodroma*, *Halobæna*, and *Garrodia* are as yet unrepresented among the skeletons under my charge.

Prion has a skeleton closely resembling that of *Daption* and the forms associated therewith, in this and Forbes's papers. It differs from these mainly in the great breadth of the boat-shaped upper jaw and in the short wide palatines; in its pelvis it most nearly resembles *Bulweria* and *Œstrelata*.

Coming to the DIOMEDEIDÆ, I regret that of the genera *Thalassogeron* and *Phœbetria* I have only seen skulls, but the differences

between these and that of *Diomedea* seem sufficiently marked to entitle them to the rank of genera. The collection contains complete skeletons of two species of *Diomedea*.

The hemipterygoid of the Petrel is here described and figured (Pl. XXIII. figs. 3, 4) for the first time.

The indications of the Ciconiiform affinities of the Petrels pointed out by other writers have been verified and additional points brought to light. It would seem that the Petrels must be regarded as a very ancient group, undoubtedly by no means remotely allied to the Sphenisci, Colymbi, and the Ciconiiformes. Their Ciconiiform affinities are most clearly seen perhaps through the palate. That of *Diomedea*, for instance, presents many points in common both with *Fregata* and with *Ciconia* that can hardly be attributed to any other source than that of derivation from a common ancestor. The holorhinal nares, the temporal fossæ, and deep supra-orbital grooves they share in common with the Penguins and the Divers. The pelvis of the Procellariidæ seems to be traceable to a form most closely resembling that of the Penguins. That of the Diomedeidæ is more specialized, and in the adult, at least, resembles not a little that of the Ciconiiform type. Besides the Petrels, the Grebes and Divers are the only other birds which have the cnemial crest greatly developed so as to rise high above the articular surface of the femur. This can hardly be regarded as an adaptation in the case of the Petrels, for they are not great swimmers, and do not therefore use their legs as do the Divers.

As to the arrangement of the group in the present paper, I can only regret my inability to adopt *in toto* that of any of those to whose works we are so greatly indebted; it is to be hoped that in the near future some sort of harmony will come of the existing somewhat unsatisfactory state of affairs. The present scheme—as adopted in this paper—though based largely on the osteology, is not entirely founded thereon; but has been framed with a due regard to the claims of other anatomical facts.

xi. Key to the Osteology of the Tubinares.

A. Skull. (Plates XXII., XXIII.)

The skull is holorhinal and schizognathous; with more or less deep supra-orbital grooves; a large, laterally expanded vomer fused posteriorly with the palatines; an olfactory cavity of great size; a large antorbital plate; and a hooked upper jaw.

A. Supra-orbital grooves without an external overhanging ledge; temporal fossæ, when present, in the form of deep depressions approaching one another in the middle line, and tending to cut off the cerebral from the cerebellar portions of the skull; external nares large, divided into right and left apertures by a narrow bar of bone in the mid-dorsal line; length of the upper jaw never greatly exceeding that of the cranium; orbito-sphenoid imperfectly ossified; basipterygoid processes well developed or in the form of minute prickles; with a conspicuous tubular parasphenoidal pneumatic aperture opening downwards above the Eustachian grooves; palatines long, sharply defined anteriorly at their junction with the maxillo-palatine processes, which are small and plate-like lamellæ never projecting

downwards beyond the level of the tomium, nor extending backwards into the lachrymo-nasal fossæ; interorbital septum perforate.
PROCELLARIIDÆ.

a. Width of the basitemporal plate slightly or not at all exceeding the length of the pterygoid..... *Procellariinæ*.

b. Width of the basitemporal plate much exceeding the length of the pterygoid—very slightly less than the distance between the quadrates.
Pelecanoidinæ.
(One genus only, *Pelecanoides*.)

B. Supra-orbital groove with a more or less extensive overhanging ledge, the free edge of which is flattened; temporal fossæ represented by shallow semicircular depressions of uniform depth, separated each from its fellow by the broad, quadrangular, shield-shaped roof of the skull; external nares small, opening laterally underneath a broad culmen; orbitosphenoid completely ossified; length of the upper jaw greatly exceeding that of the cranium; basipterygoid processes absent, with the parasphenoidal pneumatic aperture opening above the Eustachian groove in a narrow chink; palatines closely approximated in the middle line so as nearly to conceal the vomer; palatines relatively short, becoming fused distally with the maxillo-palatine processes, which project downwards far below the level of the tomium; maxillo-palatine processes large, more or less fenestrated, extending vertically upwards and backwards into the lachrymo-nasal fossa..... DIOMEDEIDÆ.

Key to the Genera of Procellariinæ.

GROUP A. Supra-orbital grooves, shallow but very wide, semilunar in shape, almost or quite meeting in the middle line; lachrymal free, with a wide chink between its dorsal border and the frontal; temporal fossæ feebly developed or absent.

a. Without spine-like wings behind the supra-orbital grooves.

a'. Basipterygoid processes absent; maxillo-palatines approaching the mid-ventral line, distinct from the palatines; supra-orbital grooves separated by a thin linear ridge ..... *Oceanites*.

b. With a conspicuous pair of "wings" behind the supra-orbital grooves.

b'. Basipterygoid processes vestigial—in the form of prickles; maxillo-palatines approaching in the middle line, and partially fused with the palatines.

a''. Supra-orbital grooves separated by a shallow median groove.
Cymodroma.

b''. Supra-orbital grooves separated by a median linear ridge.
Fregetta.

c'. Basipterygoid processes absent; maxillo-palatines approximating to the middle line, and quite distinguishable from the anterior ends of the palatine; supra-orbital grooves separated by a thin linear ridge..... *Pelagodroma*.

GROUP B. Supra-orbital grooves very narrow, excavated out of the free edge of the frontal and separated by a very broad interorbital median ridge.

a. Basipterygoid processes represented by minute prickles; lachrymal free, its dorsal border closely applied to the frontal; maxillo-palatine processes concealed from below by the palatines ..... *Procellaria*.
Halocyptena [1].
Oceanodroma.

[1] Adult skulls of *Halocyptena* and *Oceanodroma* not represented in the Museum collections.

Group C. Supra-orbital grooves deep and wide, sharply defined, and tending to meet in the middle line; pterygoids rod-shaped, with articular surfaces for the basipterygoid processes—which are often vestigial; vomer more or less boat-shaped, not cleft more than half its length; length of anterior nares never more than ½ that of upper jaw.

a. Lachrymal free.

a'. Supero-external angle of antorbital plate incomplete, forming with the lachrymal a large foramen ..... *Puffinus.*
Priofinus.
Majaqueus.

b'. Supero-external angle of antorbital plate complete, closing the space between itself and the lachrymal ..... *Bulweria.*

b. Lachrymal anchylosed with nasal.

c'. Size very large; basioccipital with well-developed mammillary processes; a large space between the dorsal border of the antorbital plate and the frontal; postorbital processes turning downwards and ending in a point; lachrymal with the horizontal greatly exceeding the vertical axis; quadrato-jugal bar with a strongly marked triangular process for articulation with the quadrate..... *Ossifraga.*

d'. Size not exceeding 4 inches; basioccipital without mammillary processes; postorbital processes with a squarely truncate outer border; lachrymal with the horizontal and vertical axes about equal; quadrato-jugal bar of uniform thickness throughout.

a''. Interorbital region of frontals dividing supra-orbital grooves moderately wide; lachrymal with its postero-dorsal free edge produced laterally into a pair of conspicuous wings.

a^3. Vomer tapering anteriorly to a point; beak stout and wide, not conspicuously narrower at the tip; anterior palatine vacuity very wide, not bounded by a flattened ledge on either side; palatines elongated, ventral surface conspicuously keeled posteriorly.

a^4. Temporal fossa deep, nearly meeting in mid-dorsal line. *Fulmarus.*

b^4. Temporal fossa shallow, divided by the roof of a distinct cerebellar prominence .... *Daption.*

b^3. Anterior end of vomer more or less hidden by the maxillo-palatine processes, which meet in the middle line; palatines short and broad, proximal end *not* conspicuously keeled; anterior palatine vacuity narrow, bounded on either side by a flattened ledge; beak more or less conspicuously depressed, the extreme form resembling that of *Balæniceps*..... *Prion.*

c^3. Vomer terminating anteriorly in a long spine; palatines elongated; beak slender.

c^4. Anterior limb of free bifid end of lachrymal longest; interorbital region of frontals less than width of supra-orbital groove . *Thalassœca.*

d^4. Posterior limb of bifid end of lachrymal longest and directed backwards; interorbital region of frontals much greater than width of supra-orbital grooves ..... *Œstrelata.*

b''. Supra-orbital grooves divided by a thin bony ridge ... *Priocella.*

Diomedeidæ.

a. Interorbital region of frontals broad; antorbital plate not extending outwards to the level of the outer margin of the lachrymal; with a well-marked tubercle lying between the mammilary processes.

a'. Interorbital region of frontals not exceeding ⅓ of the width of the frontals between the lachrymals; pterygoid ends of the frontals becoming abruptly wider in the region of a line drawn through the median palatine keel ..... *Diomedea.*

b'. Width of interorbital region of the frontals exceeding ¼ that of the frontals between the lachrymals; pterygoid ends of the palatines gently widening from behind forwards ..... *Thalassogeron.*

b. Interorbital region of frontals reduced to a narrow median ridge; antorbital plate extending outwards to the level of or beyond the outer border of the lachrymal; no tubercle between the mammillary processes. *Phœbetria.*

B. Vertebræ.

All the presynsacral vertebræ are free and heterocœlous; the centra of the thoracic bear more or less conspicuous lateral depressions and are often highly pneumatic; only the 2nd–5th or 6th cervicals bear neural spines; all the cervicals from the 2nd bear ribs in the form of elongated and very slender styles, they become free and bear a distinct capitulum and tuberculum on the last 3 vertebræ (cervico-dorsals); the free caudal vertebræ bear distinct intercentra, and in the larger species the neural arch of each is provided with a pair of processes directed forwards and embracing the neural spine of the vertebra next in front; catapophyses of cervicals never meeting in mid-ventral line to form a canal.

A. Many if not all the thoracic vertebræ bear elongated hypapophyses, of which the cephalad are bifid..... *Procellariidæ.*

B. Thoracic vertebræ without hypapophyses..... *Diomedeidæ.*

C. Sternum and Pectoral Girdle.

The posterior border of the sternum may be either notched or entire. In the former the anterior coracoid border is produced forwards beyond the level of the anterior lateral process. In the latter the anterior coracoid border does not project far forwards. The base of the coracoid is always of great width, and the furculum articulates by ligament with the antero-ventral angle of the carina.

A. Pneumatic foramina of the dorsal surface of the sternum, when present, never very conspicuous, and confined to the anterior region of the middle line; carina sharply defined throughout the whole length of the sternal plate; spina interna absent ..... *Procellariidæ.*

a. Coracoid grooves forming markedly oblique angles with the long axis of the sternum; base of coracoid more than ½ as broad as long; articular surfaces of sternal ribs extending backwards far beyond the anterior lateral processes.

a'. Posterior border of the sternum entire; clavicle with a hypocleideum; spina externa pointed.

a''. Hypocleideum small; width of posterior border of sternum much less than its long axis ..... *Procellaria.*

b''. Hypocleideum long.

*a*³. Width of posterior border of sternum = length of long axis of sternal plate; carina unfenestrated ..... *Cymodroma.*

*b*³. Carina fenestrated; posterior border of sternum wider than length of long axis..... *Fregetta.*

*c*³. Carina fenestrated; with posterior border of sternum less than long axis; anterior lateral process only slightly projecting above the base of the coracoid; width of base of coracoid falling far short of length of its long axis ..... *Oceanites.*

*d*³. Metasternum projecting beyond the posterior lateral processes; carina fenestrated; anterior lateral processes projecting considerably over the base of the coracoid; width of coracoid at base nearly equal to the length of the shaft; width across posterior border of sternum less than its long axis ..... *Pelagodroma.*

b'. Posterior border of sternum with four deep notches; spina externa blunt or bifid ..... *Puffinus.*
Majaqueus.
Bulweria.
Prion.
Œstrelata.
Pagodroma.

c'. Outer pair of notches obliterated or feebly developed (sometimes forming fenestræ) ..... *Priocella.*
Thalassœca.
Fulmarus.
Priofinus.

d'. Posterior border of sternum with 4 very slight notches; corpus sterni with pneumatic opening on anterior region of dorsal surface.
Ossifraga.

b. Coracoid grooves forming a right angle with the sternum; base of coracoids not more than ½ the width of the long axis; sternal ribs almost entirely confined to anterior lateral process; furculum without a distinct hypocleideum; posterior border of corpus sterni entire... *Pelecanoides.*

B. Pneumatic foramina of dorsal surface of sternum conspicuous, extending along the whole length of median line of the sternum; carina merging into the sternal plate some distance in front of the metasternum; posterior lateral processes projecting far beyond the level of the metasternum.
Diomedeidæ.

D. Pelvic Girdle.

Pre- longer than post-acetabular ilium; ischium produced far backwards in the form of a long narrow bar of bone, its free end deflected and firmly bound to, or even fused with, the pubis, so that the obturator fissure is closed behind; obturator foramen never completely shut off from the fissure.

A. Pre-ilia not meeting in the mid-dorsal line above the neural crest of the synsacrum; innominate free.

a. Size small, total length of pelvis not exceeding 1·4 in.; postacetabular ilium with its dorsal border obliquely truncated and ill-defined; free ends of ischium and pubis fused.

a'. Obturator fissure very narrow; pre-ilia widely separated; obturator foramen open posteriorly; lumbar enlargement of synsacrum large and lying in front of the acetabular region.

a''. Pre-ilium not expanded distally ..... *Procellaria.*
b''. Pre-ilium expanded distally ..... *Oceanodroma*.

b'. Obturator fissure very wide; lumbar enlargement of synsacrum slight, lying in mid-acetabular region.

c''. Pre-ilia not rising beyond the level of the base of the synsacral neural crest; obturator foramen separated from the fissure by a broad bar of bone ..... *Pelagodroma.*

d''. Pre-ilia rising to the level of the top of the neural crest, or nearly so.

*a*³. Obturator foramen and fissure confluent.

*a*⁴. Dorsal border of pre-ilium pressed closely to the lumbar enlargement, which is almost entirely preacetabular; greatest width of synsacrum about ½ its length ..... *Oceanites.*

*b*⁴. Dorsal border of pre-ilium separated by a deep groove from the lumbar enlargement; greatest width of synsacrum about ½ its length ..... *Cymodroma.*

*b*³. Obturator foramen separated from the fissure by a broad bar of bone; pre-ilia pointed in front ..... *Fregetta.*

b. Size larger, not less than 2½ in. (*Bulweria* alone excepted); postacetabular ilium with dorsal border well-defined and terminating in a well-marked spine.

c'. Pre-ilium moderately broad and expanded distally, resting upon the synsacrum and partly concealing it; ischium having its free end more or less sharply deflected.

e''. Post-ilium with flattened dorsal aspect, rapidly tapering to form a laterally-compressed blade-like edge, terminating in a spine; obturator foramen an elongated oval twice length of the acetabulum; free end of ischium bent at right angles to long axis, narrow and tapering to a point ..... *Puffinus.* *Majaqueus.*

f''. Post-ilium slightly or not at all compressed dorsally; pubis projecting distinctly beyond the ischium; ischium with broad flattened foot closely articulating with pubis.

*c*³. Ischiadic foramen nearly circular; dorsal border of pre-ilium concave.

*c*⁴. Width of dorsal aspect of post-ilium rapidly decreasing from before backwards; post-iliac spine ill-defined ... *Thalassæca.*

*d*⁴. Width of dorsal aspect of post-ilium broad throughout; post-iliac spine well-defined..... *Priocella.*

*d*³. Ischiadic foramen oval; dorsal border of pre-ilium straight.

*e*⁴. Thoracic vertebra immediately in front of pre-ilium fused with synsacrum.

*a*⁵. Entire length of pelvis not less than 3½ in. ..... *Fulmarus.*

*b*⁵. Entire length of pelvis not exceeding 2½ in. ..... *Daption.*

*e*³. Lumbar enlargement forming a distinct tumid swelling in front of acetabulum.

*f*⁴. Ischium never completely fused with pubis posteriorly.

*c*⁵. Anterior border of pre-ilium obliquely truncated; ischium tapering to a fine point ..... *Œstrelata.*

*d*⁵. Anterior border of pre-ilium squarely truncated; ischium of equal width throughout ..... *Bulweria.*

*g*⁴. Pubis completely fused posteriorly with ischium ... *Prion.*

d'. Pre-ilium reduced to narrow bars, separated one from another by the whole width of the synsacrum; ischium in the form of a long slender spine running directly backwards ..... *Pelecanoides.*

B. Pre-ilia meeting in the mid-dorsal line above the synsacral neural crest; suture dividing innominate bones from synsacrum almost or quite obliterated.

a. With a more or less well-marked pectineal process; free end of ischium turning downwards in a strong curve; pubis of uniform thickness throughout; cavity of pelvis not divided into anterior and posterior renal fossæ ..... *Ossifraga.*

b. No pectineal process; free end of ischium not abruptly curved; cavity of pelvis distinctly divisible into anterior and posterior renal fossæ; ribs of sacral vertebræ extending across renal cavity immediately behind acetabulum ..... *Diomedea.*

E. Pectoral Limb.

Humerus with a shallow coraco-humeral groove; a triangular pectoral crest not extending far down the shaft; crista inferior very small, formed for the most part by the downwardly-directed tuberculum inferius; with a large ecto-epicondylar process, and a more or less deep fossa for the brachialis internus; the sub-trochanteric fossa is in no case of more than medium size, and never subdivided into two; the ulna is without an olecranon process; the phalanx of the pollex and the 2nd phalanx of Mc. II. are of great length.

A. Humerus non-pneumatic; crista inferior never inflated along its free edge. *Procellariidæ.*

B. Humerus pneumatic; crista inferior inflated along its preaxial border; sub-trochanteric fossa small, receiving several pneumatic foramina. *Diomedeidæ.*

F. Pelvic Limb.

All the bones non-pneumatic; tibio-tarsus with a greatly enlarged ecto-cnemial crest forming a large flabelliform crest rising high above the articular surface; with an extensor bridge; outer and middle toes of equal length; hallux more or less vestigial; tibio-tarsus with a more or less well-marked intercotylar tubercle; 1st phalanx of D. II. = to or longer than that of D. III.

A. Hypotarsus complex ..... *Procellariidæ.*

a. Tarso-metatarsus longer than the outer toe.

a'. Ungual phalanges flattened; basal phalanx of middle toe as long as or longer than next two taken together (*Forbes*).

a''. Tarso-metatarsus markedly longer than the outer toe, grooved anteriorly throughout, its length = ⅓ that of the tibio-tarsus; ph. 1 of D. II. longer than ph. 1, D. III. & IV. ..... *Cymodroma.*

b''. Tarso-metatarsus much longer than outer toe; trochlea all in same plane; grooved anteriorly, much flattened distally antero-posteriorly; 3 toes nearly = ph. 1, D. II. & III., = longer than IV. *Fregetta.*

c''. Tarso-metatarsus longer than outer toe, ⅔ as long as tibio-tarsus; fibular ridge scarcely longer than the width across the proximal articular surface of the tibio-tarsus; basal phalanges of D. II. and III. = and longer than that of IV. ..... *Oceanites.*

d''. Tarso-metatarsus much longer than the outer toe, ⅔ as long as tibio-tarsus, with a shallow groove throughout its whole length; basal phalanges D. II. and III. = and longer than IV.; outer and middle toes equal..... *Pelagodroma.*

b'. Ungual phalanges pointed; basal phalanx of middle toe shorter than next two joints (*Forbes*).

e''. Tarso-metatarsus only slightly longer than the outer toe; fibular ridge obsolete..... *Procellaria.*

b. Tarso-metatarsus shorter than outer toe, but much longer than femur.

c'. Fibular ridge obsolescent.

f''. Tarso-metatarsus faintly grooved anteriorly, its outer border raised into a sharp ridge ..... *Puffinus.*

g''. Tarso-metatarsus deeply grooved anteriorly, outer border not conspicuously developed ..... *Bulweria.*

d'. Fibular ridge distinct.

h''. Tarso-metatarsal groove nearly obsolete ..... *Daption.* / *Prion.*

i''. Tarso-metatarsus grooved anteriorly and posteriorly ... *Œstrelata.*

j''. " " "

*a*³. Groove deeper, length not exceeding 2½ in. ..... *Majaqueus.*

*b*³. Groove shallower, length not less than 3¾ in. ..... *Ossifraga.*

c. Tarso-metatarsus shorter than outer toe, scarcely longer than femur.

k''. Tarso-metatarsal groove obsolescent, hallux present.

*c*³. Ectocnemial crest stronger; shaft of tibio-tarsus not exceeding 3½ in. ..... *Thalassœca.*

*d*³. Ectocnemial crest weaker; shaft of tibio-tarsus not exceeding 3¾ in..... *Priocella.*

l''. Tarso-metatarsal groove obsolescent; hallux absent ... *Pelecanoides.*

B. Hypotarsus simple; ectocnemial large, forming an acute angle with the entocnemial crest proximally; fibular ridge scarcely raised above half of shaft ..... *Diomedeidæ.*

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EXPLANATION OF THE PLATES.

Plate XXII

c.p. = cerebellar prominence.
c.r. = coronal ridge.
l. = lachrymal.
n. = nasal.
n.pmx. = nasal process of premaxilla.
q. = quadrate.
s.c. = sagittal crest.
sq.p.w. = squamoso-parietal wing.
s.o.g. = supraorbital ridge.
s.o.l. = " ledge.
t.f. = temporal fossa.

The Dorsal Aspect of the Skull.

Fig. 1. The skull of *Puffinus kuhli*, nat. size, to show the large temporal

fossæ, the backward position of the squamoso-parietal wings, the sagittal crest, coronal ridge, and large supraorbital grooves and lachrymals.

Fig. 2. The skull of *Prion vittatus*, nat. size (p. 389), to show the great development of the upper jaw, the form of the supraorbital grooves, the cerebellar prominence, temporal fossæ, and fused lachrymals.

Fig. 3. Skull of *Procellaria pelagica*, nat. size (p. 404), to show the feebly-developed supraorbital grooves and the great width of the interorbital region of the frontals.

Fig. 4. The skull of *Cymodroma melanogaster*, nat. size (p. 404), to show the form of the supraorbital grooves, the spine-like wings of the free end of the squamosal, and the lachrymals, which are partly separated from the frontals by a space.

Fig. 5. The skull of an Albatross, *Diomedea exulans*, ⅓ nat. size (p. 404), to show the great size of the supraorbital groove and ledge, and the shallow femoral fossæ, confined to the lateral surface of the cranium.

Fig. 6. The skull of *Oceanites oceanicus*, nat. size (p. 404), to show the form of the supraorbital grooves.

Plate XXIII.

Additional Letters.

als. = alisphenoid.
a.o.p. = antorbital process.
ant. = antrum of Highmore.
an.h. = „ „ „
b.p. = basipterygoid process.
bt.p. = basitemporal platform.
b.s. = basisphenoid.
c.b.v. = cerebral vein.
eu.g. + *pn.ap.* = Eustachian groove + pneumatic aperture.
ep.o. = epiotic.
ex. = exoccipital.
f.f. = floccular fossa.
fr. = frontal.
h.pt. = hemipterygoid.
m. = meatus internus.
mes. = mesethmoid.
op. = opisthotic.
p. = parietal.
pa. = palatine.
par., *pr.* = parasphenoid.
pn.ap. = pneumatic aperture.
pro. = proötic.
pt. = pterygoid.
s.o. = supraoccipital.
s.s. = squamosal spine.
sq. = squamosal.
t.r. = temporalis recess.
v = vomer.
v.f. = vagus foramen.

Fig. 1. Lateral aspect of skull of nestling *Oceanodroma leucorrhoa*, outer view, ×2 (p. 393), to show the unclosed sutures.

Fig. 2. Lateral inner view, longitudinal section, of same skull (fig. 1), ×2, to show unclosed sutures.

Fig. 3. Dorsal aspect of palatines, pterygoid, and vomer, ×2 (p. 396), to show the form and relations of the hemipterygoid.

Fig. 4. Lateral aspect of a portion of fig. 3, ×3, outer view, to show relations of hemipterygoid.

Fig. 5. Ventral aspect of *Pelecanoides garnoti*, nat. size (p. 383), to show the form and great size of the basitemporal platform.

Fig. 6. Dorsal aspect of the vomer and neighbouring parts of the skull of *Diomedea exulans*, ⅓ nat. size (p. 390).

Fig. 7. Lateral aspect of same dissection as fig. 6, to show form of vomer, ⅓ nat. size (p. 391). Note in figs. 6, 7, and 8 the antrum of Highmore.

Fig. 8. Ventral aspect of skull of *Diomedea exulans*, to show the schizognathous palate, ⅓ nat. size (p. 390).

2. On the Breeding of the Weka Rail and Snow-Goose in Captivity. By F. E. Blaauw, C.M.Z.S.

[Received February 15, 1899.]

I. The Weka Rail (*Ocydromus australis*).

A pair of Wekas, kept in a small enclosure in my park, began to exhibit the first signs of breeding in the end of February of last year (1898). The birds became very noisy and were heard screaming in concert, as well during the day as during the night. The male became extremely attentive to the female, and, if fed with bread or anything else that was acceptable to him, would take as much of the food in his bill as it could possibly hold, and run towards the female, calling her by a peculiar drumming noise. As soon as she came to him, he would give her the whole of his provisions, and would only eat himself what she left. He delighted so much in feeding her that, if she were present whilst the food was thrown before them, he would snatch it away from her in great haste to present it to her afterwards.

The beginning of the nesting-operations was a rather deep circular hole, which the male excavated with his powerful bill under a box-tree. The female soon began to join him in this work, and afterwards would sit in it whilst the male went about in search of material for the nest. This consisted of loose grass and hay, but chiefly of grass dug out with the roots adhering to it, which he would bring in big mouthfuls to the female, who set it in order about her. This went on for several days, the nest growing very large considering the size of the birds. It measured ultimately fully 25 inches across, the borders being raised about 11 inches, whilst the depression in the middle was so deep as to almost entirely hide the bird which sat in it.

Both male and female took part in the construction of the nest, but the bringing and collection of the materials seemed to be exclusively the work of the male. On the 26th of March the first egg was laid, and the following five were laid with generally, but not always, one day between each egg. The eggs are of a buffish white, with lighter and darker red spots, which have the appearance of some being on the surface of the shell and of others being under it. The eggs resemble closely those of *Aramides ypecaha* from the Argentine Republic. After three eggs had been laid the birds began to sit, each sitting alternately. The male sat mostly during the night and the female during the day, but sometimes, though seldom, the reverse would occur. This lasted during a fortnight, and I thought everything was going on as it should, when, one morning, I was much grieved to find that all the eggs were gone—eaten by the parent birds, as I found out afterwards, and the whole nest was left in disorder.

A few days after this catastrophe the Rails began to pair again and to build a new nest. Again eggs were laid, seven in number

this time, and the birds commenced to sit. My hopes of a good result ran high, as special orders had been given not to disturb the birds on any account, because I had attributed their former bad behaviour to some annoyance that had put them out of temper. During ten days incubation took place quite regularly, when again the nest was found turned upside down, with six of the eggs broken or eaten by the birds, who were still busy at this most unnatural proceeding. The seventh egg was saved and put under a bantam-hen, which brought it to maturity, so that in due time a very lively little black Weka-Rail chicken burst the shell.

Incubation had lasted, including the ten days during which the Rails had sat, 28 days. The chick was of nearly uniform slightly brownish black all over, with jet-black eyes, a slightly curved black bill, and stout reddish-black legs. The down being very long and stiff, gave the bird a very fluffy appearance, and a great resemblance to the chick of the Common Fowl.

In the chick of *Aramides ypecaha* the down is much shorter and velvety in texture, so that the form of the body remains plainly visible. The curious resemblance between the eggs of *Aramides ypecaha* and *Ocydromus australis* is, therefore, not continued in the chicks of these two very different members of the Rail family.

The little *Ocydromus*-chick uttered constantly a sharp piping note, and showed almost from the first day the intelligent boldness of its parents. It soon found out that its foster-mother had little patience in feeding it from its bill, as was expected by the little Weka, and that it had to look to the keeper's fingers for its supply of food, which chiefly consisted of small earthworms and little crumbs of bread. I had every reason to believe that it would thrive, when, unfortunately, it was discovered that it preferred mealworms to everything else. These consequently were given to it, but seemed to have disagreed with it, for its digestion became disordered, and after a couple of days' illness it died when just a week old.

The old birds went on making nests and laying a great number of eggs. Several of these were eaten, as the first two clutches were; a number were also saved and placed under common hens, but they all proved to be unfertilized, so that I did not succeed in getting any more chicks. This strange propensity of eating their own eggs was not restricted to this individual pair of birds, as another pair let loose in a wooded enclosure of about three acres behaved in just the same way. The birds made a nest, sat on the eggs during a few days, and then destroyed everything. This last pair was of a most ferocious disposition, and the male even destroyed some young Rheas which were running about along with their father in the same enclosure. They also killed other birds.

All Wekas are remarkable for their tameness and intelligent behaviour, so that, where their destructiveness is no hindrance, they make very amusing pets. They use their wings only when

running about, on which occasions they will keep them uplifted at different angles to their body. They can dig deep holes in the ground with their bills, and use this power to make their escape under a fence. My two pairs differed much in size; and in the larger pair the ground-tone of the plumage was very rufous, whilst in the smaller pair the ground-tone was more dusky. In both pairs, the males were larger than the females. They seem to be very hardy birds, as they walk about most contentedly in the snow.

II. The Snow-Goose (*Chen hyperboreus*).

Since the year 1887 I have possessed a pair of the white Snow-Goose (*Chen hyperboreus*). These birds were kept in company with a number of other aquatic birds on a small piece of ornamental water in my park. Every spring they paired, got very much excited, and attempted to wander away, but no eggs were laid.

Three years ago I purchased what was supposed to be a pair, but which soon turned out to be two males of the Blue or Cassin's Snow-Goose (*Chen cærulescens*). One of these males constantly followed the pair of White Snow-Geese, and as he seemed not to be too intrusive, he was, after some lame attempts on the part of the white male to drive him away, allowed to do as he liked. This went on for two years, when, in the spring of 1898, the blue male began to assert himself more and more, and finally got the mastership over the white male, and entirely monopolized the white female. In the end of May they were frequently seen to pair, and one of the first days in June a nest was made near the edge of the pond, on a heap of dry reeds that happened to be there, and the first egg was laid. With one day between each egg, two more eggs followed, and the female, after having plucked an abundant supply of down from her own breast, began to sit.

A curious thing now occurred. The blue male kept active watch near the nest, and attacked furiously every living thing that came near. The white male, however, who had taken the most lively interest in the proceedings of his unfaithful spouse, not being allowed to come near the nest, kept watch on the other side of the water, just opposite the sitting bird, and there kept the coast clear, in exactly the same way as did the blue male on the side where the female actually sat.

Between the two the female was very successfully taken care of, for no accident happened, and on the 8th of July, that is after an incubation of 29 days, the three eggs produced three chicks, which were of a dark olive-green colour, ranging into slaty black on the upperside and into yellowish on the belly. The feet and legs and also the bill were black.

As for fear of Crows and vermin the family had to be removed into some safe place, I thought it right to give the white male some compensation for all he had had to undergo, and to reunite him with his rightful partner, leaving the usurper in the pond. Both the white birds seemed to be quite happy with this arrange-

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J.Smit del. et lith.

Mintern Bros. imp.

LEPUS CRAWSHAYI.

ment, and took the greatest care of the chicks, as if everything was as it should have been.

The little birds grew extremely fast, so that at the age of seven weeks they were almost of the size of the parents, fully feathered, and able to fly. These first feathers presented a brownish slaty-grey colour all over the bird, the wing-coverts and tertiaries having lighter edges, the whole of the plumage being very glossy. The legs and bills, which had gradually turned from black into grey, now began to show signs of assuming the pinkish colour proper to the adult bird of this species. On the bills the pink became visible in stripes or lines.

At the age of eleven weeks the heads got white feathers and the brownish body-feathers began to be replaced, especially at the sides, by the more bluish-grey ones of the adult Cassin's Snow-Goose. At the present time (February 3rd, 1899) the heads are nearly white and the rest of the bodies are nearly moulted, the brownish-grey feathers being replaced by bluish-grey ones; so there is little doubt but that they will assume the typical plumage of *Chen cærulescens* without any undue mixture of white.

As when two good species cross, the offspring nearly always presents the mixed appearance of the parents, I consider this result of the interbreeding of my Blue and White Snow-Geese as an additional proof, if such were wanted, of the non-validity of the White and Blue Snow-Geese as separate species. The two forms being only colour-variations, there was no reason for a mixed coloration in the offspring. The young have simply taken the colour which is probably most adapted to the circumstances under which the birds live. In this case it was the plumage of *Chen cærulescens*. Judging from these facts, I also think it probable that the intermediate forms which are found in North America in a wild state are not so much the result of the interbreeding of the typical White and Blue forms, as the produce of a range of country where the circumstances which formed the White or Blue forms are not sufficiently pronounced.

3. On two Hares from British East Africa, obtained by Mr. Richard Crawshay. By W. E. de Winton, F.Z.S.

[Received March 6th, 1899.]

(Plate XXIV.)

Mr. Richard Crawshay, who is so well known as a traveller and contributor to our knowledge of the fauna of Africa, has lately sent to the National Collection two Hares from British East Africa. One of these belongs to an already described but little known species, hitherto recorded only from North-eastern Somaliland; the other is a very distinct and apparently undescribed form, which I propose to name, in honour of the collector, *Lepus crawshayi*.

LEPUS SOMALENSIS Heuglin, Nov. Act. Acad. Leop. 1861, xxviii. p. 5.

This is a pale-coloured Hare, with a more or less strong wash of black owing to the outer hairs being mostly black-tipped; the ears are very long, edged with black at the extreme tips only, inner margin dull yellow; the nape is pale fawn; throat dull sand-colour; there are no distinct lines between the colours of the upper and under surfaces; there is a wash of yellow on the edge of the dark colour on the inside of the thighs; the tail has a clear black broadish line above.

Collector's note:—"Ukamba, 5000 ft., Athi Plains, July 15th, 1898. Weight about 3½ lbs. This Hare frequents the bare open plains of the Upper Athi River, where there is not a tree for miles and miles."—*R. C.*

Measurement of the ear in the dry specimen 120 millim.

The upper incisors are moderate in width, with the front surfaces level; the grooves are placed near the inner edge, they are shallow, diverging inwardly, and entirely filled with cement.

The back of the nasal bones is gradually bowed from the outward edge, forming a wide V.

This Hare is closely allied to *L. tigrensis* Blanf., from Abyssinia, and probably that species does not differ much except in being rather larger. It would also stand very close to *L. ægyptius* in an arrangement of the genus.

LEPUS CRAWSHAYI, sp. n. (Plate XXIV.)

General colour very dark, all the hairs broadly tipped with black, subterminal band golden, the hair rather straight and shining; the nape, forelegs inside and out, throat, and a line between the colours of the upper and lower surfaces bright rust-coloured; the face is very rich black and gold; the ears are moderate, with a black spot on the back of the tips; the tail is rather long, with a broad band of black above.

Incisors rather narrow, flat in front.

The only specimen is labelled—"♂. Neugia Kitwi, 3400 ft., Oct. 1898. Shot in barren hills amongst thorny scrub where there is no fresh vegetation. Weight 3½ lbs."—*R. C.*

Measurement of the ear in the dry specimen 97 millim.

Outwardly this Hare closely resembles *L. whytei* from Nyasaland, but the points of the fur are black, and not dark brown as in that species.

The skull of *L. crawshayi* is about the size of that of *L. whytei*; the nasals are shorter, and the face-line droops more than in that species; the fronto-nasal suture forms a deep V in the middle line.

The rather narrow upper incisors are quite flat, the inner and outer sides of the grooves being on the same level; whereas in *L. whytei* these teeth are very broad, the part on the inner side of the groove projects considerably, and on the outer side of the

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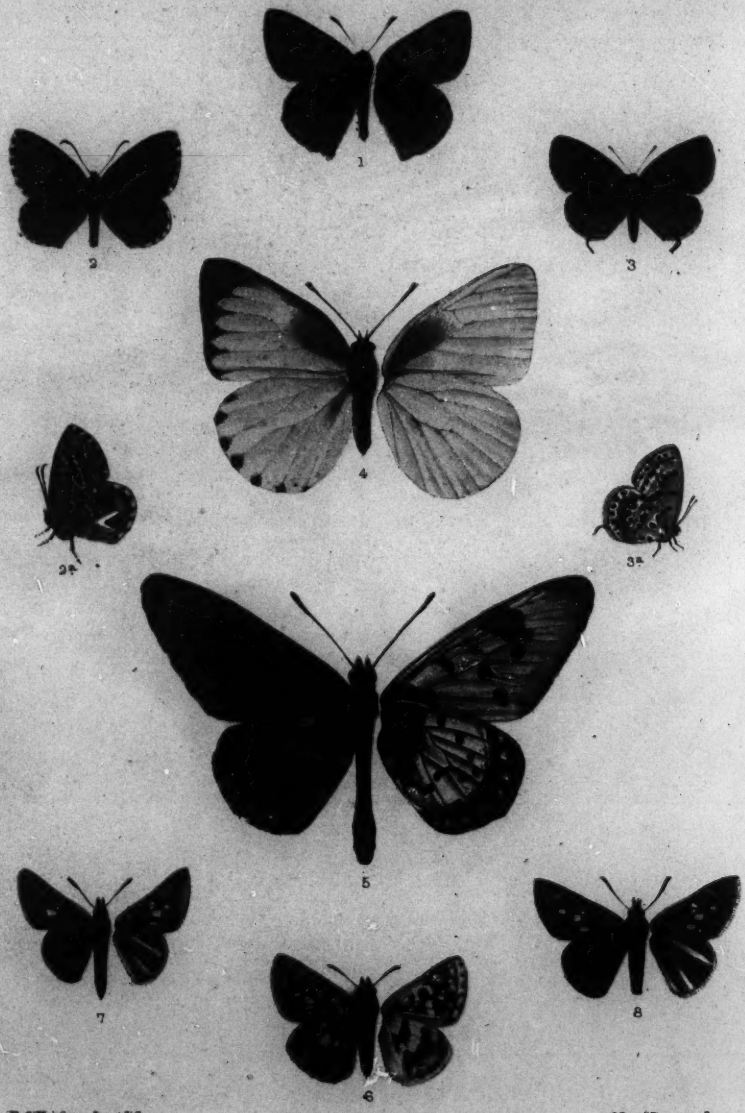


E. C. Knight, ad nat lith. West, Newman, chromo.

BUTTERFLIES FROM BRITISH EAST AFRICA.

groove there is a second shallow furrow; the teeth of *L. victoriæ* are also very broad, with the inner portion much raised, the outer portion slopes off considerably, being at the same time depressed towards the middle: thus the skulls of these three Hares are readily recognized by a glance at their incisors. The enamel-folds forming the grooves in the upper incisors of this new Hare are lance-shaped, cutting straight into the teeth antero-posteriorly, and completely filled with cement. The folds of the enamel in the teeth of *L. whytei* are almost globular, with a peak in the middle line posteriorly. Those in the teeth of *L. victoriæ* are more complicated, the sides diverging considerably, forming two points postero-laterally with a concave hinder margin.

The discovery of distinctive characters in the incisor teeth of Hares is entirely due to the researches of Dr. Forsyth Major, with whom I have had the good fortune to be associated and who is now engaged in writing on that subject; these characters were pointed out to me as likely to assist in the determination of species, and I have found them most valuable.

EXPLANATION OF PLATE XXIV.

Lepus crawshayi, sp. nov., p. 416.

4. On two small Collections of Butterflies made by Mr. Richard Crawshay during 1898 in British East Africa.

By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c., Senior Assistant-Keeper, Zoological Department, Natural History Museum.

[Received February 27, 1899.]

(Plate XXV.)

Towards the end of last year we received a box of Lepidoptera from Mr. Crawshay containing 83 Butterflies and 218 Moths, chiefly collected at Machako's; and, in January of the present year, a second consignment of 35 Butterflies, 143 Moths, and a Dipteron[1], chiefly collected *en route* from Machako's to Naugia (or Neugia). The present paper gives an account of the Butterflies in these two series; the Moths will eventually be worked out by Sir George Hampson.

As usual, Mr. Crawshay has sent home nearly the whole of the specimens in admirable condition, and has carefully labelled the whole with exact locality, date of capture, and in some cases with the altitude at which they were obtained; notes on the habits are often added, as well as the colouring of the eggs obtained from the bodies of gravid female examples.

Three new species are described in the present paper—*Acræa*

[1] According to Mr. Austen a *Dichætometopia* (possibly *D. tessellata*, Macq.).

astrigera, *Scolitantides crawshayi*, *Pyrgus machacosa*, as well as the females of *Everes kedonga* (the male of which was described last year by Mr. Grose-Smith) and of *Phrissura nyasana*, the male of which I described and figured in these 'Proceedings' for 1896. Other species of especial interest are *Castalius gregorii*, *Scolitantides stellata* (which we previously only possessed from Nyasaland), *Chrysophanus abbotti*, *Stugeta bowkeri*, *Teracolus celimene*, *Synchloe glauconome* (previously only received from near Aden), *Abantis paradisea*, and a curious form of *Kedestes wallengreni*.

Writing from Ngong (or Ngongo), Masailand, on September 6th, respecting the first of his consignments, Mr. Crawshay says:—"It is almost two months since I sent my collection of Butterflies and Moths, which by now I hope will have reached you. In the meantime I have never had a chance of writing to you; I have been on the move incessantly ever since.

"The very day I consigned the box of insects to the Parcel Post I received orders to proceed hither: right glad was I, too, to get the chance of seeing something of Masailand.

* * * *

"Having collected some 300 odd Butterflies and Moths, the latter being *by far* the most numerous, I thought I had better send you these by way of a first instalment. All these insects were taken, as you will see from the envelopes, either at, or in the vicinity of Machako's Station—which is the headquarters of what has been delineated as the Ukamba Province, though it also includes the much more important and interesting highlands of Kikuyu (the home of the Wakikuyu, who are strong men) and a portion of Masailand.

"The altitude of Machako's is about 5400 feet. It is open plain-land, not even well watered; but there are hills in the immediate neighbourhood, such as Makimwi and Mowa, partially timbered, partially open down-land, nearly 1000 feet higher, where I took practically all the most interesting Butterflies, and many of the day-flying Moths, such as the 'Bee' and 'Humming-Bird Hawks.'

"It is not a rich Butterfly country I could see at once; it is, however, a rich field for Moths; those I took in my tent at night alone gave me plenty to do to put them up: had I 'sugared' I should have secured a great many more.

"The rainy seasons of Ukamba are on from about the beginning of March until the end of May, and again from about the middle of October until the end of December; this *last* rainy season there was very little rain indeed.

"Since I left Machako's I have been steadily collecting all the time, except when on the Kegujo expedition, when I never ceased regretting not having brought my net, as there are some lovely and, to me, quite new Butterflies in the forests of Kikuyu; but, of course, we had sterner work in hand there."

In answer to a letter which I wrote (acknowledging the receipt

of this first instalment) I received a communication dated Dec. 19th, 1898, addressed from ten miles about East of the Athi River, Kitwi, British East Africa, in which Mr. Crawshay says:—"I was afraid the Butterflies would disappoint you. However, as you will have seen from my previous letter from Masailand, which could not have reached you before you wrote, the localities where I have been collecting hitherto are *not* rich in Butterflies, though richer in Moths. *The* Butterfly-country of this part of Africa, I predict, will be the dark lofty forests of Kikuyu in the neighbourhood of Mt. Kenia (visible at a respectable distance, 130 to 150 miles, I suppose, from where I am now camped: I saw it last evening).

"Shortly you should receive another lot of Lepidoptera which I sent off from Mombasa about a month ago, and which comprises some insects taken in Massai and some at Neugia[1], with others taken hither and thither in my goings out and in my comings in. I have now about 100 other insects towards another consignment: they include a lot of very likely-looking Moths, but only about 3 Butterflies, all 'Blues,' which are new to me."

The lot referred to in the preceding letter was the second of the two consignments treated of in the present paper.

Nymphalidæ.

Satyrinæ.

1. Samanta perspicua Trimen.

♀, Machako's, 26th June, 1898.

"Only one specimen seen. Pale watery-green ova." (*R. C.*)

This example belongs to the typical wet-season phase, but the ocelli on the under surface are rather small.

2. Neocænyra gregorii Butler.

♂ ♂, Machako's, 24th April and 3rd July, 1898.

The example obtained in April was taken at Ulu, 5400 feet.

Nymphalinæ.

3. Junonia sesamus Trimen.

Wet phase— ♂, Machako's, 25th June, 1898.

Dry phase— ♂, 1st July, 1898. "The first of this species I have seen at Machako's." (*R. C.*)

It will be noted that the extreme wet and dry phases were taken within a week of each other; but it should be distinctly understood that, as phases existed before they were adapted to the seasons, and still appear in many localities where there are no defined seasons (as, for instance, at Aden, where a shower even

[1] On some of Mr. Crawshay's labels this is spelt Naugia, so that I am doubtful of the correct spelling.—*A. G. B.*

is exceptional), the terms 'wet phase' or 'dry phase' merely indicate that a particular form is prevalent in the wet- and another in the dry-season. Even Mr. Marshall, who discovered the seasonal relationship of the utterly dissimilar phases of this species, would hardly venture (in contradiction of his own dated examples) to assert that either phase was exclusively limited to its proper season.

4. JUNONIA CLOANTHA Cramer.

♂ ♀, Machako's, 2nd and 24th June; ♀, 3rd July, 1898.

The female obtained on the 24th June has a lightly-marked border above, and a pale distinctly-marked and ocellated under surface; it should therefore be a wet phase; the other pair (taken earlier and later) are unquestionably dry: this is another instance of untimely appearance in a seasonal phase.

5. JUNONIA ELGIVA Hewits.

♂, Kikuyu, 11th September, 1898.

6. JUNONIA CEBRENE Trimen.

♂ ♂, Machako's, 28th May, 20th and 25th June, 1898.

7. JUNONIA BOOPIS Trimen.

♂, Kikuyu, 11th September, 1898.

8. HYPANARTIA HIPPOMENES Hübner.

♂, Machako's, 3rd July, 1898.

9. PYRAMEIS CARDUI Linn.

Machako's, 3rd July, 1898.

10. ATELLA PHALANTHA Drury.

Machako's, 26th June, 1898.

"Fairly plentiful in the hills adjoining Machako's, but I do not remember having seen one specimen in the open flats." (*R. C.*)

11. BYBLIA ILITHYIA Drury.

♀, Machako's, 2nd July, 1898.

ACRÆINÆ.

12. ACRÆA ALICIA E. M. Sharpe.

♂ ♂, Machako's, 24th May and 3rd July, 1898.

13. ACRÆA LYCIA var. DAIRA Godm.

♂. On the road from Machako's to Naugia, 4800 feet, 18th September, 1898.

14. ACRÆA ACRITA var. PUDORINA Staud.

♂, Machako's, 3rd July, 1898.

"First of its species I have seen." (*R. C.*)

15. Acræa astrigera, sp. n. (Plate XXV. fig. 5.)

♂. Allied to *A. acara* var. *barberi*, but having the size and general aspect of the largest and brightest examples of typical *A. acara*; on the primaries the spots of the postmedian series are small and arranged in a regular line (as in *A. acrita*); the bar crossing the end of the cell has a small spot below it, and exactly resembles that in *A. anemosa*; the looped submarginal line of *A. acara* is only represented by two dusky dots beyond the lowest spot of the postmedian series; the secondaries have no white patch and no black spot on the discocellulars; the black outer border is as wide as in *A. acara*, but is more sharply defined and traversed by a series of pure white dots; the fringe also is pure white between the veins: on the under surface the differences between this species and *A. acara* are of the same kind.

♂. On the road from Machako's to Naugia, 4800 feet, 18th September. 1898.

Although this is a beautiful insect in its fresh rosy colouring, I could wish to have seen more specimens before describing it; because, while it is perfectly distinct and well-marked, yet the possession of a female example would have shown whether it should be placed nearer to *A. acara* or *A. anemosa*. It appears to come nearer to the former.

16. Acræa cerasa Hewits.

Kikuyu, 6400 feet, 17th July, 1898.

Lycænidæ.

17. Polyommatus bæticus Linn.

♀, Machako's, 10th July, 1898.
"Emerald-green ova." (*R. C.*)

18. Catochrysops perpulchra Holland (= peculiaris Rogenh.).

♀, Machako's, 3rd July, 1898.

19. Tarucus plinius Fabr.

♀, Machako's, 26th June, 1898.
"Bright grass-green ova." (*R. C.*)

20. Zizera gaika Trimen.

♂ ♂, Machako's, 28th May and 19th June, 1898.
"Very plentiful: has to be almost driven off the ground—flies so low." (*R. C.*)

21. Castalius gregorii Butler.

♂ ♂, ♀ ♀, Machako's, 13th and 24th June, 1898.
"By no means common; three seen in a day's walk." (*R. C.*)
It is satisfactory to find that this species, of which we previously possessed only the type, is quite constant.

22. CASTALIUS HINTZA Trimen.

♀, Machako's, 2nd July, 1898.

23. LYCÆNESTHES LIODES Hewits.

♂, Kikuyu, 19th July, 1898.

24. LYCÆNESTHES AMARAH Lefebvre.

♂ ♂, Machako's, 28th May, 1898.
"Taken on bush." (*R. C.*)

25. SCOLITANTIDES STELLATA Trimen.

♂ ♂, ♀, Ngongo, 6450 feet, Masailand, 3rd and 8th August, 1889.

"Here, at Ngongo, there is a tiny speckled grey 'blue,' coloured and marked very like the 'Grizzled Skipper,' which I have never seen before, and which is very common." (*R. C.*)

On the labels Mr. Crawshay notes two as having been taken from the same blue flowers with a single swoop of the net. It is evident that he has forgotten having captured two examples of the same species in Nyasaland; but, considering the extent and variety of his collections, this is by no means surprising.

26. SCOLITANTIDES CRAWSHAYI, sp. n. (Plate XXV. figs. 2, 2*a*.)

♂. Allied to *S. methymna*, but smaller, the basal area sprinkled with silvery grey-blue scales; primaries below with the white-edged macular bands narrower, composed of rather small confluent spots scarcely darker than the ground-colour; secondaries blackish at base, followed by two subparallel series of dark brown white-edged spots, the outer series united, by a conical spot filling the base of the second median interspace, to a broad internally serrated brown patch which tapers to costa near apex; a well-defined V-shaped white stripe partly bounding internally an uneven submarginal series of more or less Λ-shaped dark brown markings; the usual black spot enclosing a metallic silver-blue crescent on the first median interspace: head below white, terminal joint of palpi and distal fringe black; pectus and front legs whitish, tarsi greyish; remaining legs blackish above, whitish below; venter mostly dark grey, whitish in the centre at base. Expanse of wings 30 millim.

Machako's, 3rd July, 1898.

About the size of *S. battus*, but much nearer to *S. methymna*.

27. EVERES KEDONGA. (Plate XXV. figs. 3, 3*a*.)

♂. *Everes kedonga*, Grose-Smith, Novit. Zool. v. p. 357 (1898).

♀. Black-brown above with purplish and bronze reflections; the basal area of the primaries sprinkled with ashy scales; a submarginal snow-white dash at external angle continuous with an ill-defined submarginal ashy line; secondaries with the interno-

median area pale blue, interrupted and succeeded by a macular bright orange discal band consisting of five spots, of which that above the anal margin is bifid; a submarginal series of prominent black spots with white outer edges; marginal line of all the wings black; the fringe with its basal half smoky-grey, its outer half snow-white; tail black with white tip: underside as in the male. Expanse of wings 27 millim.

♀, Machako's, 10th July, 1898.

Mr. Grose-Smith has kindly identified this very pretty species for me.

28. Cacyreus lingeus Cramer.

♀, Machako's, 3rd July, 1898.

29. Zeritis harpax Fabr.

♂ ♂, Machako's, 3rd, 7th, and 20th June; Machako's to Naugia, 13th July, 1898.

30. Chrysophanus abbotti Holland. (Plate XXV. fig. 1.)

♂, hills near Machako's, 26th June, 1898.

"I have not observed this species in the immediate neighbourhood of Machako's, but in the adjoining hills." (*R. C.*)

31. Lachnocnema bibulus Fabr.

♀, Naugia, 3rd October, 1898.

32. Virachola antalus Hopffer.

♂, Machako's, 26th June; ♀, Machako's to Naugia, 14th July, 1898.

"♂, several seen playing about a clump of bush, but nowhere else"; "♀, emerald-green ova." (*R. C.*)

The female has the margins of the markings below bright rust-red. I have never before seen an example so vividly coloured.

Var.? The male is paler on both surfaces, less purple above, and has the lines much more regular below, the subanal markings on the secondaries silvery green (not golden green); the female is distinctly lavender-blue above with well-defined dusky borders; the markings outlined in stone-grey; no black spots towards the base of secondaries. Altogether this is a smaller form than typical *V. antalus*: it is a common West-African butterfly.

♀, Machako's, 10th July; ♂, Machako's to Naugia, 4300 feet, 22nd September, 1898.

33. Stugeta bowkeri Trimen.

♂ ♀, Machako's, 28th May, 1898.

The female was "taken on a bush just as she had nearly finished depositing her ova, grass-green in colour." (*R. C.*)

PAPILIONIDÆ.

PIERINÆ.

34. MYLOTHRIS AGATHINA Cramer.

♀, Machako's, 1st July, 1898.

"By no means plentiful at Machako's; indeed I think the first I have seen." (*R. C.*)

The single specimen of this common and widely distributed butterfly obtained is much shattered.

35. COLIAS ELECTRA, var. EDUSA Fabr.

♂ ♂, ♀, Machako's, 26th June and 10th July; Kikuyu, 6400 feet, 17th July; Ngongo, 14th and 30th August, 2nd September, 1898.

"Not plentiful, but an odd specimen here and there." "♀, var. *helice*, oblong pale green ova." (*R. C.*)

36. TERIAS SENEGALENSIS, var. BISINUATA Butler.

♀ ♀, Machako's, 26th June, 1898.

37. TERACOLUS CALAIS Cramer.

♀, Machako's, 10th July, 1898.

38. TERACOLUS INCRETUS Butler.

♂ ♂, Machako's, 3rd June; Machako's to Naugia, 14th July. 1898.

"The first of this species which I have seen actually at Machako's." "By no means plentiful." (*R. C.*)

39. TERACOLUS ANTEVIPPE, var. SUBVENOSUS, Butler.

♂, Machako's, 28th May, 1898.

40. TERACOLUS CELIMENE Lucas.

♂ ♂, Machako's, 26th June; Machako's to Naugia, 18th September, 1898.

41. TERACOLUS AURIGINEUS Butler.

♂ ♀, Machako's, 26th June and 3rd July, 1898.

"Rarely, if ever, met with on the open flats in the neighbourhood of Machako's: but fairly plentiful in the adjoining hills, amidst upland forest." "♀ dark yellow ova." (*R. C.*)

42. TERACOLUS CATACHRYSOPS Butler.

♂, Mwani, Uganda road, 28th October, 1898.

"Taken in dwarf forest." (*R. C.*)

43. CATOPSILIA FLORELLA Fabr.

♀, Machako's, 3rd July, 1898.

44. Belenois mesentina Cramer.

♂, Machako's, 10th July, 1898.

45. Belenois westwoodi Wallengr.

♀, Machako's to Naugia, 4800 feet, 18th September, 1898.
"Dirty-white spike-shaped ova." (*R. C.*)
The single female obtained is of the dry-season phase; on the upper surface it is far less marked than usual.

46. Synchloe glauconome Klug.

♂, Machako's, 28th May, 1898.
This is the first African example of the species that I have seen; it is slightly less heavily spotted than Arabian specimens, but is otherwise identical.

47. Phrissura nyasana Butler. (Plate XXV. fig. 4.)

♀, Machako's, 3rd July, 1898.
"Dirty-white ova." (*R. C.*)
There can, I think, be no doubt that this is the female of the Nyasa species; it is rather smaller than the male and has the usual broad costal border and dentate-sinuate outer border to the primaries; the cell of these wings is almost wholly orange as in the male; below, the chief difference consists in the much whiter secondaries with the marginal spots reduced to black dots.

48. Herpænia melanarge, var. iterata, Butler.

♂, Machako's, 28th May, 1898.

49. Eronia dilatata Butler.

♂, Machako's, 20th June, 1898.
"Occasionally met with on these open plains, but evidently more at home and more plentiful in the bush country." (*R. C.*)
This is the driest phase of the species that I have seen.

Papilioninæ.

50. Papilio demoleus Linn.

Kikuyu, 6400 feet, 17th July, 1898.

Hesperiidæ.

51. Sarangesa pertusa Mabille.

Machako's, 22nd and 24th June, 7th July, 1898.
"Frequents dry ravines and spots of bare sheltered ground." (*R. C.*)

52. Sarangesa eliminata Holland.

Machako's, 21st and 22nd June, 1st July, 1898.

53. Eretis djælælæ, var. lugens Rogenh.

Machako's, 3rd, 15th, and 28th May, 25th June and 10th July, 1898.

"Perhaps the commonest butterfly met with singly—here, there, and everywhere." (*R. C.*)

54. Abantis paradisea Butler.

Naugia, Kitwi, 4000 feet, 18th and 30th September, 1898.

All the specimens were "taken perching on a straw protruding from the thatch of the house-roof (three of them) on a bright hot day at noon." (*R. C.*)

55. Pyrgus machacoana, sp. n. (Plate XXV. fig. 6.)

On the upper surface this species exactly resembles *P. ferox* (Wallgr.), but is slightly larger: on the under surface it differs in the elbowed creamy subapical transverse stripe on the primaries (which is straight in *P. ferox*) and in the less regular arched bands on the secondaries, the central white band being broader and abruptly drawn back at first median branch so as to impinge upon the olive-brownish band behind it, and from that point narrowed to half its width, the olive-brownish discal band being abruptly widened into a sort of heel to fill the area thus left vacant; the submarginal white stripe is broken up into unequal spots, some of which are almost obliterated. In addition to these important differences, the white spots on both surfaces of the primaries are much purer than in *P. ferox*. Expanse of wings 31 millim.

♂, ♀ ♀, Machako's, 6th, 7th, and 26th June, 1898.

"Fairly common; bluish emerald-green and pale grass-green ova." (*R. C.*)

I hope Mr. Crawshay will send more examples of this pretty little Skipper-butterfly.

56. Gomalia elma Trimen.

Ngongo, 22nd August; Kikuvu, 11th September, 1898.

"♀. Bright green ova." (*R. C.*)

57. Kedestes wallengreni, var., Trimen. (Plate XXV. figs. 7, 8.)

♂ ♀, Machako's, 3rd and 10th July, 1898.

"♀. Very large greenish-yellow ova." (*R. C.*)

The specimens forwarded by Mr. Crawshay have two defined divergent white stripes on the under surface of the secondaries; but a male sent by Mr. Marshall shows a second (though less well-defined) stripe, through the interno-median area; thus forming a transitional grade. Mr. Crawshay's male shows very little white on the abdominal border of the secondaries, and has the discal yellow spots characteristic of the female well-marked. In this species the transparent spots which cross the middle of the primaries vary from four to six in number; both Mr. Crawshay's

examples and a female in the collection from Estcourt having only four spots.

58. GEGENES LETTERSTEDTI Wallengr.

♂ ♂, Machako's, 3rd and 10th July; ♀ ♀, Kikuyu, 17th and 19th July, 1898.

"♀. Greenish-white ova." (*R. C.*)

59. PARNARA MATHIAS Fabr.

♂ ♂, ♀, Machako's, 23rd and 25th June; Kikuyu, 8th September, 1898.

60. PARNARA BORBONICA Boisd.

♂, Ngongo, 6450 feet, Masailand, 3rd August, 1898.
A very fresh and brightly coloured example.

61. RHOPALOCAMPTA FORESTAN Cramer.

Machako's, 3rd July, 1898.

62. RHOPALOCAMPTA PISISTRATUS Fabr.

Kikuyu, 6400 feet, 17th July, 1898.

EXPLANATION OF PLATE XXV.

Fig. 1. *Chrysophanus abbotti*, ♂, p. 423.
2, 2*a*. *Scolitantides crawshayi*, ♂, p. 422.
3, 3*a*. *Everes kedonga*, ♀, p. 422.
4. *Phrissura nyasana*, ♀, p. 425.
5. *Acræa astrigera*, ♂, p. 421.
6. *Pyrgus machacoana*, ♀, p. 426.
7, 8. *Kedestes wallengreni*, var. *δ*, ♀, p. 426.

April 18, 1899.

Prof. G. B. HOWES, LL.D., F.R.S., V.P., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of March 1899:—

The total number of registered additions to the Society's Menagerie during the month of March was 83, of which 43 were by presentation, 31 by purchase, 3 were born in the Gardens, and 6 were received on deposit. The total number of departures during the same period, by death and removals, was 98.

Amongst the additions may be specially noticed:—

1. A female of the Kiang or Wild Ass of Tibet, received on deposit March 11th and subsequently purchased. The Kiang makes a good addition to the Society's series of the Horse-family (*Equidæ*), only two examples of this scarce animal having been previously in the Gardens. These were also females, of which one

was presented by the late Major W. E. Hay, F.Z.S., in 1859, and the other was received on deposit in 1885.

2. An example of Pel's Owl (*Scotopelia peli*), a fine and rare species of Owl from the Niger Territory, presented by Lieut. E. V. Turner, R.E., March 28th.

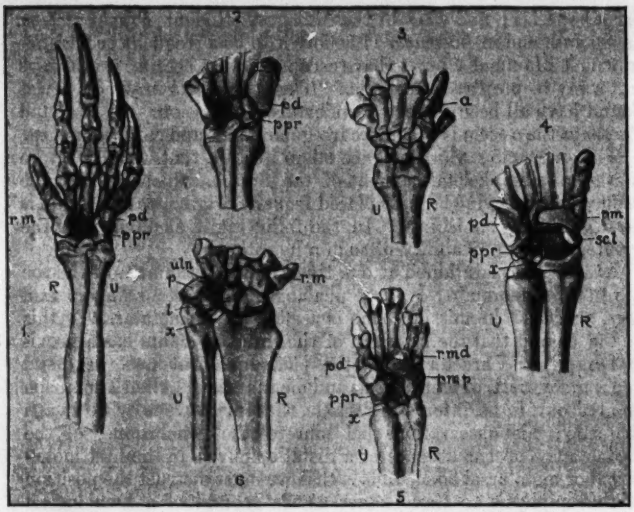
Pedetes caffer.

3. A Cape Jumping-Hare (*Pedetes caffer*), presented by Mr. W. Champion of Durban, Natal, March 31st. This singular Rodent seems to be a very delicate animal, which does not thrive in captivity. Though several of our correspondents have attempted to send us specimens, this is the first that has reached us alive.

Mr. Smit's drawing shows its attitude in life, with the fore feet scarcely visible as it sits up. It is semi-nocturnal in habits.

Dr. C. I. Forsyth Major exhibited the carpus of the fossorial Rodent *Ctenomys* (see figures, p. 429), and made the following remarks:—

The carpus exhibited was taken from the dry skin of a species of the fossorial Hystricoïd *Ctenomys*, from the Province of Salta (Argentina), which the Natural History Museum owes to Dr. Moreno. It presents three special peculiarities, to which I wish to draw attention.



Carpus of *Ctenomys*, etc.

Fig. 1. *Ctenomys* sp. (Br. Mus. No. 97. 10. 3. 68). Left manus, palmar view. R=radius; *r.m*=radiale marginale. U=ulna; *ppr*=proximal pisiform; *pd*=distal pisiform.—Fig. 2. *Ctenomys* sp., Prov. Salta (Argentina). Left carpus, palmar view.—Fig. 3. Same specimen as Fig. 2. Left carpus, dorsal view. *a*=interphalangeal dorsal ossicle.—Fig. 4. *Mus macleari* Thos., jun. Right carpus, palmar view. *rm*=proximal marginal radiale. *x*=accessory palmar ossicle of the carpus; *sc.l*="scapholunar."—Fig. 5. *Arvicanthis niloticus*. Right carpus, palmar view; *rm.pr*=proximal marginal radiale; *r.md*=distal marginal radiale.—Fig. 6. *Lepidolemur microdon* Maj. Right carpus, palmar view. *l*=lunar; *uln*=ulnare. The bones marked *x* and *p* (pisiform) are separated by a short meniscus of connective tissue, which unfortunately is made to appear in the figure as a distinct bone.—Figs. 1–3 and 6 slightly over nat. size; figs. 4 and 5 about double nat. size.

I.

On the dorsal side of the thumb (*a*, fig. 3), overlapping the interphalangeal articulation, is a lengthened ossicle, attached by a strong ligament to the proximal end of the ungual phalanx, and gliding on the capitulum of the second. The anterior and posterior extremities of this ossicle are slightly swollen, the shaft being restricted, so that it somewhat resembles a diminutive phalanx.

So-called sesamoid bones have been here and there noticed, as rare occurrences, on the dorsal surface of the phalangeal articulations in Mammalia; they will be enumerated hereafter; but I have nowhere found a mention of an ossicle on the interphalangeal articulation of the thumb. On investigating the matter more closely, I have found the same ossicle constantly in the four species of *Mus* up to the present examined, including our two common

larger species; and also in the Malagasy Rodent *Brachyuromys*, in *Spalax*, and in *Lagomys*. I believe it to be a frequent occurrence amongst Mammalia, but to have escaped notice, because it is always cut away in prepared skeletons. The individuals in which it was found have all been dissected under my supervision. In *Mus* and *Lagomys* the ossicle is of a more irregular shape and reduced in size.

The suggestion which at once offers itself is, that we have before us the missing skeletal element of the thumb, which has become reduced after having been displaced from its original position, and is now gradually vanishing. In the following I shall consider the greater or less probability of such a hypothesis.

It has been maintained at one time, that the thumb and the toe have the same number of three phalanges as the other fingers and toes, and that the missing bone is a metacarpal (metatarsal): this on the ground that the proximal of the three segments has a proximal epiphysis characteristic of the phalanges, but not the distal one characteristic of metacarpals and metatarsals.[1] Allen Thompson pointed out, in an interesting article, that the above is by no means the rule; his observations led him to the conclusion "of the inconstancy of the absence of a distal epiphysis in the first metacarpal or metatarsal bone, and... that we must distrust the position of the epiphysis to these bones as the ground of a homological distinction."[2] Dollo has since shown that in the young *Varanus* all the metacarpals and metatarsals have a proximal as well as a distal epiphysis[3]; a fact which, held together with the cases in Mammalia quoted and described by A. Thompson, and to which I could add further instances, makes it probable that all the Mammalian metacarpals and metatarsals had originally likewise two epiphyses.

Having discarded as invalid the reasons which would assign three phalanges to the first digit and toe, the next question to answer is, whether the missing phalanx is the first, the second, or the third. Pfitzner has pointed out that, in those Mammals in which the ungual phalanx has either totally (some Monkeys) or almost totally (Wombat, Elephant) disappeared, the next phalanx shows not the least tendency to assume the form of the former[4]. He concludes from this[5] that it is the middle phalanx which has disappeared, and that its disappearance is due

[1] Struthers: "On Variation in the number of Fingers and Toes, etc." Edinb. New Philos. Journ. vol. xviii. p. 111 (1863).

[2] "On the Difference in the Mode of Ossification of the first and other Metacarpal and Metatarsal Bones." Journ. Anat. & Phys. iii. pp. 131–146 (1869).

[3] Zool. Anz. vii. p. 80 (1884).

[4] W. Pfitzner, "Die kleine Zehe." Archiv f. Anat. u. Entwicklungsgesch. p. 34 (1890).

[5] *L. c.* pp. 34, 35: "Ich glaube somit annehmen zu müssen, dass auch die Zweigliedrigkeit des Daumens und der grossen Zehe der Säugethiere und des Menschen, und ebenso die Dreigliedrigkeit der übrigen Zehen und Finger in der Weise zu Stande gekommen ist, dass immer das jeweilige Endglied das nächstfolgende durch Verschmelzung sich assimiliert hat."—See also Pfitzner, in Morph. Arb. i. p. 605 (1892): "Das Interphalangealgelenk des ersten Fingers bin ich geneigt mit dem proximalen Interphalangealgelenk der anderen Finger zu homologisiren, seine Endphalanx als Verschmelzungsproduct von Mittelphalanx und ursprünglicher Endphalanx anzusehen."

to its having been fused ("assimiliert") with the terminal phalange. The condition described in *Ctenomys* etc., while supporting the first part of Pfitzner's contention, seems however to point out, that in part at least of the Mammalia the disappearance of the second phalange has been brought about by elimination and not by "assimilation."

In the pes of the Insectivore *Chrysochloris*, the phalanges of all the five toes are reduced to two, and all the five toes show a dorsal ossicle riding on the interphalangeal articulation. This coincidence would seem to be significant; but I have at once to state, that in the manus of *Oryzoryctes tetradactylus*, which has the normal number of three phalanges in the four digits present, I have found the ossicle in question on the distal interphalangeal articulation of the second digit, and do not doubt that it was present on the others also.

The only recorded dorsal ossicles of Man occur on the metacarpo-phalangeal articulation of the thumb, and are noticed by Kulmus[1]; one case also having been found by Pfitzner[2]; in the same place, on the great toe an ossicle is recorded by Kulmus[3]. In the Canidæ, dorsal ossicles are limited to the metacarpo- and metatarso-phalangeal articulations[4]. The dorsal ossicles of the manus of *Talpa europæa* have been figured repeatedly (Blainville, Owen, Flower, &c.), but nowhere do I find a reference made to them in the description of the skeleton, which almost seems to show that they have not been recognized as free ossicles, but considered to be processes of the phalanges. In this Insectivore the three middle fingers of the manus have each two dorsal ossicles, one on the metacarpo-phalangeal articulation, and one on the proximal interphalangeal. In the first and fifth digits only the latter articulation shows an ossicle. In the pes I find them only on the proximal interphalangeal articulations of all five toes. In a skeleton of *Condylura*, the dorsal ossicles seem to have been partly cut away, so that I cannot make a definite statement. It is noteworthy that, on the proximal interphalangeal articulation of the fifth digit and on the homonymous articulation of the fourth toe, two ossicles are present. In a mounted skeleton of *Myogale moschata* in the Natural History Museum, I find dorsal ossicles on the proximal interphalangeal articulations of the second, third, fourth, and fifth digits (on the latter there are two ossicles). In the pes, the articulator has almost thoroughly done his "duty," for there is only one dorsal ossicle present, viz., on the proximal interphalangeal articulation of the third toe. In *Oryzoryctes tetradactylus*, dorsal ossicles, in addition to the above-mentioned, occur also on the second, third, and fourth proximal interphalangeal articulations of the manus, as well as on the same articulation of the fifth toe, and may have been cleaned away in the other proximal interphalangeal,

[1] Kulmus, 'Tabulæ anatomicæ,' p. 62 (1732); id., Miscellanea Med. Phys. ii. p. 328 (1720). Quoted from Pfitzner, Morph. Arb. i. pp. 604, 742 (1892).
[2] Morph. Arb. i. pp. 604, 685 (1892).
[3] *L. c.*; *cf.* Pfitzner, *l. c.* p. 742.
[4] See Pfitzner, Morph. Arb. i. p. 603 (1892).

as well as in the metacarpo- and metatarso-phalangeal articulations.

Among the Rodents, I have for the present come upon dorsal ossicles—apart from the one on the first digit—in *Lagomys*, viz., on the metacarpo-phalangeal articulation of the second, third, and fourth digits, and in *Spalax*. In the manus of the latter, dorsal ossicles are present on the proximal interphalangeal articulations of the 2nd–5th fingers; in the pes, on the interphalangeal articulation of the first, and on the proximal interphalangeal articulations of the four other toes. As regards Edentates, it has been stated that "a sesamoid bone is developed on the dorsal side of the metacarpal-phalangeal articulations" of *Orycteropus*[1]. In the skeletons of the Cape Anteater available to me, all traces of these had been carefully made to disappear.

From the above fragmentary evidence it can be argued that careful research will show these dorsal "sesamoids" to be a not uncommon occurrence; it will then be time to investigate them more closely. They too may have been originally intercalated between the phalanges, and would point towards a more remote condition than does the interphalangeal dorsal ossicle of the thumb. As to the opinion that their function is to facilitate the sliding of the tendons over osseous protuberances, and to enlarge the angle of insertion of the tendons, I may be allowed to refer to what Pfitzner has said on the subject[2].

II.

The pisiform of *Ctenomys* is composed of two bones (figs. 1 & 2), as found by von Bardeleben in *Bathyergus maritimus*[3], and moreover the distal one has, in one species (fig. 2), a horny sheath, comparable to the nail-like structure—found by O. Thomas and described by von Bardeleben[4]—on the so-called præpollex of *Pedetes*; and to a somewhat similar one stated by Prof. Howes to overlie the enlarged "præhallux" of *Cercolabes*[5]. The two discoveries of von Bardeleben[6]—by the way, the two bones of *Pedetes* were described by Meckel in 1825—are among his chief arguments in support of his assumption of a sixth and seventh finger; accordingly, the proximal bone of the pisiform of *Bathyergus* was considered "as in all probability the carpal, and

[1] Flower: 'An Introduction to the Osteology of the Mammalia,' 3rd ed., p. 309 (1885).

[2] "Erläutern wir dies an dem Beispiel der Sesama dorsalia. Wenn irgend Jemand, so hätten alsdann die 'Greifhänder' solche nöthig, die Affen und der Mensch; warum finden wir sie aber statt dessen bei den Caniden, bei denen das betreffende Gelenk fast immer in Ueberstreckung bleibt? Warum nicht eher bei den Feliden, die in diesem Gelenk schon viel energischer beugen?" (Morph. Arb. i. p. 610, 1892).—Besides, these dorsal ossicles of Canidæ are only loosely connected with the extensor tendons ("an die Strecksehnen nur locker angeheftet") (id. ib. p. 604). See also ib. pp. 567–571, 609–612.

[3] P. Z. S. 1889, p. 260, pl. xxx. fig. 3.

[4] Id. ib.

[5] *L. c.*; Bardeleben, *l. c.* p. 260, footnote.

[6] K. v. Bardeleben: "Hand und Fuss. Referat erstattet auf der 8. Vers. d. Anat. Ges. in Strassburg" (Verh. d. Anat. Ges. viii. p. 283, 1894).

the distal as the metacarpal segment of the postminimus."[1] In his last utterances on the subject[2], neither the pisiform and calcaneus, nor the so-called præpollex and præhallux, are considered as true carpal and tarsal bones, but "they have the same rank and position as the metacarpal and metatarsal bones."

What for palæontologists has been scarcely doubtful from the beginning of the discussion, becomes still clearer by the recent researches, viz., that the Tetrapoda have always been pentadactyle[3]; so that we may use "Pentadactylia" as synonymous with Tetrapoda. The remains of supernumerary rays must be traced to stages beyond the tetrapodous. Although a finger (toe) is a ray or part of one, the more general term "ray" (Strahl) is not synonymous with finger (toe): to use the two terms promiscuously is equivalent to deliberately confusing the discussion.

Where we meet among Mammals with an especial development of those supernumerary rays, this condition can always be traced to their secondary adaptation to special functions, as was long ago insisted upon by Winge and others[4].

As to the pisiform, a more or less ossified distal element seems to be a common occurrence among Rodentia; apart from *Bathyergus* and *Ctenomys*, I find it in all the species of *Mus* up to the present examined (*pd.* fig. 4), including *Mus decumanus* and *Mus alexandrinus*; it is present too in *Brachyuromys ramirohitra* and in *Arvicanthis niloticus* (fig. 5, *pd.*). In all of these its special development is apparently due to an adaptation to either climbing or fossorial functions (to the latter in *Bathyergus*, *Ctenomys*, *Mus nativitatis*), or to both combined.

The so-called os Daubentonii of the Gibbon, about which more will be said farther on, is according to an observation by Leboucq, the most proximal part of the Mammalian pisiform; from its position it cannot be considered as an "ulnare antebrachii" (Thilenius); but seems to be the only part of the pisiform belonging to the carpus.

[1] P. Z. S. 1889, p. 260.

[2] P. Z. S. 1894, p. 373.—'Hand und Fuss,' p. 312.

[3] *Cf. e. g.* Emery, in Semon's 'Forschungsreise,' ii. p. 399 (1897): "Die Zahl der echten Finger und Zehen ist und war immer auf fünf beschränkt."

[4] In his "Referat" (p. 336), von Bardeleben admits that this may be the case with the "præpollex" of *Pedetes*, although on a preceding page the same had been adduced as a convincing argument in favour of his case: "... drittens suchte Ref. nach Säugetieren, die nicht nur das *Rudiment* eines Præpollex, sondern einen 'wirklichen Finger' hätten—im Sinne *Gegenbaur's*, der dafür ein Metacarpale und einige Phalangen verlangt.

"Nach dem alten, so recht für den Wahlspruch eines Naturforschers geeigneten Worte: 'Suchet, so werdet ihr finden,' gelang es damals (1889) auch, nicht nur bei *Reptilien*, fossilen und lebenden Schildkröten u. a. einen Præpollex und Præhallux nachzuweisen, sondern sogar *Säugetiere* zu finden, bei denen der Præpollex (*Pedetes capensis*), oder der Postminimus (*Bathyergus maritimus*) aus *zwei* Knochen besteht . . . .*Pedetes* besitzt aber nicht nur zwei Knochen im Præpollex-skelet, sondern einen wirklichen 'Finger' mit einem breiten, feingestreiften *Nagel*, mit Falz etc., wie Ref. für die drei Londoner Exemplare festgestellt hat....." (*l. c.* p. 283).

Neither is the large cartilage supporting the patagium of Sciuropterini an "ulnare antebrachii," as supposed by Thilenius [1], from an erroneous interpretation of the figured skeleton of "*Pteromys volucella*." [2] In the only skeleton of a Flying-Squirrel in the Nat. Hist. Mus. in which this part has been preserved (*Pteromys magnificus*), it is chiefly attached to the *distal* end of the pisiform and, besides, by a much smaller ramification, to the tuberosity of the fifth metacarpal. To judge from its position, it is therefore in the main the homologue of the *distal* pisiform of Muridæ and *Ctenomys*, and possibly of the pisiform epiphysis of many other Mammals.

A dependency of the pisiform is likewise the curious subcylindrical structure which in *Chrysochloris* "simulates a third antebrachial bone," and is by Dobson [3] and others taken for the ossified tendon of the flexor digitorum profundus. In fact, the tendons for the four digits take their origin from the distal end of this bone; from this it does not, however, necessarily follow that the bone is an ossified tendon. At the dorsal side of its distal base it is provided with two facets, the larger ulnad one for the "ulnar sesamoid," the smaller radiad one for a volar and distal projection of the lunar. More about this remarkable structure will be said elsewhere.

III.

In the fore-limb of *Ctenomys* occurs further an unusually prominent process of the radius, on the volar side of its distal ulnad end (figs. 1 & 2). In order to come to a clearer understanding, I looked for younger stages of *Ctenomys*. None being available, I resorted to *Mus*, in younger specimens of which I find in the same place, intercalated between the pisiform and the radius, a distinct ossicle (*x*, fig. 4), which later on becomes fused with the radius, thus forming the above-mentioned process. I have since found the same ossicle, though much smaller, in the fore-limb of a young individual of the Malagasy Rodent *Brachyuromys ramirohitra*, as well as in *Arvicanthis* (*x*, fig. 5). In the Rodents in which the ossicle occurs, no distinct lunar is known; they are therefore said to have a scapho-lunar bone, it being supposed that the lunar is fused with the scaphoideum.

At one time a similar statement was made with regard to Marsupials, but eventually in several genera a distinct lunar bone, although sometimes very minute, has been traced. In *Phascolarctus* no distinct lunar is known in the adult: however, in his recent memoir "Beiträge zur Entwicklungsgeschichte und Morphologie des Hand- und Fuss-skelets der Marsupialier," [4] Emery has described and figured sections of embryonic stages of *Phascolarctus cinereus*, in which appears an element which "on account of its

[1] Morph. Arb. v. p. 508 (1896).
[2] Owen, 'Anatomy of Vertebrates,' ii. p. 384, fig. 247 *a* (1866).
[3] G. E. Dobson, 'Monograph of the Insectivora,' p. 121 (1882).
[4] Semon's 'Forschungsreisen, II.' v. pp. 372, 373 (1897).

position corresponds perfectly with one which in other Marsupials (e.g. *Petaurus* and *Trichosurus*) is perfectly distinct and is interpreted as lunatum (intermedium)."[1] In the stages figured on plate 33 (figs. 5 & 6) the element of *Phascolarctus* is not entirely independent, "sondern bereits dem Radius angewachsen.—In weiter ausgebildeten Stadien finde ich keine Spur von einem solchen Element mehr, aber der Radius besitzt an der entsprechenden Stelle einen mehr oder weniger deutlichen Vorsprung, den ich als dessen Homologon betrachten möchte." Now, not only the position of this element of *Phascolarctus*, but also what Emery states about its subsequent fusion with the radius, correspond so exactly with what I find in the above-named Rodents, that both appear to be homologous. The so-called scapho-lunar of *Ctenomys*, *Mus*, *Brachyuromys*, &c. would then at first sight seem to be a greatly enlarged scaphoid, which has overtaken the functions of the lunar, the latter having become reduced and eventually fused with the radius.

Whenever we find in the carpus or tarsus of a species or whole group a large bone occupying the same place as two smaller bones in another, the conclusion nearest at hand is that the single bone is the result of the fusion of two originally distinct ossicles. But this inference is by no means always valid. I have elsewhere undertaken to demonstrate that the hamatum of Mammalia is not a compound of carpale 4 and carpale 5, but is carpale 4 only; for the obvious reason that there is a carpale 5, which however is generally cut away in the skeletons, being considered as a despicable sesamoid. In other instances it either vanishes or becomes fused with the tuberosity of the fifth metacarpal; it fuses with carpale 4 only in the case of a few Cetacea.

I will here give another remarkable instance of a similar kind. In the small Rodent group Bathyerginæ, the genera *Bathyergus* and *Georychus* (*capensis*) exhibit in their carpus a distinct ossicle, which from its position we call centrale; proximad it articulates chiefly with the equally distinct lunatum, and distad with the third and second carpale (magnum and trapezoideum). In the closely allied *Myoscalops* there is, occupying the place of the centrale and the trapezoideum of the former two genera, only one bone, which runs obliquely from the lunatum to the carpale 1 (trapezium) and, on its way, articulates also with carpale 3, as does the centrale of the two fore-named genera, and with the scaphoid and metacarpale II., as does the trapezoideum of *Bathyergus* and *Georychus*. In the tarsus of the same genera occurs the following curious parallel. In *Bathyergus* and *Georychus* the navicular is separated from the second metatarsal by the tarsale 2 (mesocuneiforme); in *Myoscalops* the navicular encroaches on the space occupied by the mesocuneiforme of the former two genera and articulates with the second metatarsale; so that the mesocuneiforme seems to be missing in *Myoscalops*. The obvious inference from this condition will of course be that the single bone in the carpus of *Myoscalops* is a

[1] *L. c.* p. 373.

centralo-trapezoid, viz., the result of a fusion of these two ossicles, which remain distinct in *Bathyergus* and *Georychus*; and that likewise in the tarsus of *Myoscalops* the single bone is a scapho-mesocuneiforme. However, on examining closely the tarsus of *Myoscalops*, I discover an almost imperceptible ossicle, comparable to a minute pin's head, attached to the proximo-tibial angle of the second metatarsal; this cannot well be anything else than the greatly reduced mesocuneiform, whose place and function has devolved on the enlarged navicular. We may further conclude, *per analogiam*, that the single bone in the carpus of *Myoscalops* is not a compound of the centrale with the trapezoid, but that the former has usurped the place of the latter, which has either completely vanished, or had become so minute that it was removed in the cleaning of the carpus.

The same reasoning cannot however be resorted to in the case of the supposed lunar of the above-mentioned Muridæ, because in *Lepidolemur* I have come upon an ossicle (*x*, fig. 6), occupying exactly the same position on the palmar side as in the Rodents; whereas in *Lepidolemur* an undoubted lunatum is present besides. We must therefore look elsewhere for the homologue of the accessory ossicle of Muridæ, *Lepidolemur*, and possibly also of the above-named Marsupials.

Kohlbrügge describes and figures in the carpus of *Hylobates syndactylus* a small bone, situated between the radius and the ulnare; "a fibrous ligament connected the ossicle with the radius and the ossiculum Daubentonii, cartilaginous tissue intervening between both."[1] Kohlbrügge calls the ossicle "*ossiculum Camperii*," the here following description by Camper of a similar occurrence in the "Mandrill" referring apparently to the same ossicle: "In the manus of the Mandrill I found on Feb. 9th, 1779, a fourth supernumerary ossicle in a ligament, which took its origin from the outside of the triquetrum and was inserted on the navicular, which latter was fastened to the radius by a small ligament."[2] Thilenius identifies this ossiculum Camperii with the "intermedium antebrachii" of the human embryo[3], which in one instance was found in adult man by Pfitzner[4]. The last-named author found besides an "intermedium antebrachii" in the left fore-limb of a *Phascolomys*[5]; the specimen is figured by Thilenius[6]: it presents itself in the form of "a roundish ossicle, situated

[1] J. H. F. Kohlbrügge: "Versuch einer Anatomie des Genus *Hylobates*." M. Weber, Zool. Ergebn. einer Reise in Niederländisch Ost-Indien, i. pp. 338, 339, pl. xvii. fig. 10 (1890–91).

[2] 'Naturkundige Verhandelingen van Petrus Camper over den Orang Outang etc.,' p. 87, footnote (b) (1782).

[3] G. Thilenius: "Das Os intermedium antebrachii des Menschen," Morph. Arb. v. p. 8 (1895); id., "Unters. üb. d. morphol. Bedeut. accessor. Elemente am menschl. Carpus (und Tarsus)," Morph. Arb. v. p. 501 (1896).

[4] W. Pfitzner, in Verh. Anat. Ges. 7. Vers. Göttingen, p. 191 (1893) ("Triquetrum secundarium"); id., Morph. Arb. iv. p. 505 (1895).

[5] Verh. Anat. Ges. 7. Vers. Göttingen, *l. c.*

[6] Morph. Arb. v. pl. i. fig. 12 (1895).

between the radius and the ulna, and articulating with the former,... its position was distad from the ligament connecting the radius and ulna, but proximad from the wrist fissure" (Handgelenkspalte).[1] To judge from the figure, this ossicle of the *Phascolomys* is situated slightly more proximad than in the Rodents and in *Lepidolemur*.

It is not for me to decide whether the ossicle of the Primates, Rodents, and *Phascolomys* is really the homologue of the human so-called intermedium antebrachii, which last in the embryo as well as in the adult is situated more ulnad, and—when it does not disappear by reduction—becomes fused with the proc. styloid. ulnæ, or secondarily imbedded in the meniscus.[2] The alternative is, that the "intermedium antebrachii" of man may be, after all, the same element of human embryos which Thilenius has called ulnare antebrachii[3], which corresponds to Pfitzner's pisiforme secundarium in the adult[4], and is besides the homologue of the "ossiculum Daubentonii" of *Hylobates* and *Inuus*[5]. To judge from Leboucq's[6] and Kohlbrügge's[7] figures and descriptions, the ossiculum Daubentonii must be assigned to the carpus rather than to the antebrachium. It seems to form, as a rule, the proximal portion of the pisiform of Mammals, except in man[8], and I consider it therefore as a marginal ulnare—the first, proximal, element of the fifth ray.

Mr. C. W. Andrews read a paper on the osteology of one of the great extinct birds of Patagonia, *Phororhacos inflatus*. He described in detail the structure of the skull and skeleton, and compared them with various recent forms of birds. The evidence as to the affinity of this type was somewhat conflicting, but on the whole pointed to a relationship with the Gruiformes, as had been previously suggested by the author. It seemed probable that the aberrant *Cariama* was the nearest living representative of *Phororhacos*, being related to it somewhat in the same fashion as the small modern Armadillos are to such great extinct forms as *Glyptodon* and *Panochthus*.

This paper will be published in full in the Society's 'Transactions.'

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[1] Morph. Arb. v. p. 10 (1895).
[2] Morph. Arb. v. p. 7 (1895).
[3] Met with in ten manus of five embryos, and situated palmad and ulnad from the proc. styl. ulnæ, and proximad from the pisiform. See Morph. Arb. v. p. 470 (1896).
[4] In five cases a proximal process of the pisiform was found. "Dieser Fortsatz war (in vier Fällen) proximal, und zugleich eher etwas dorsal als volar, gerichtet. Seine plane Fläche stellt eine continuierliche Fortsetzung der Gelenkfläche des Hauptstücks dar; im Uebrigen war der Fortsatz ringsherum durch eine tiefe Einziehung abgesetzt." Morph. Arb. iv. p. 508 (1895).
[5] Kohlbrügge, *l. c.* pp. 338, 339, pl. xvii. fig. 9 (1890–91).
[6] Arch. de Biologie publ. par Van Beneden et van Bambeke, v. p. 83, pl. iv. fig. 28.
[7] *L. c.*
[8] Leboucq, *l. c.* p. 83.

The following papers were also read:—

1. A Systematic Description of Parasitic Copepoda found on Fishes, with an Enumeration of the known Species.

By P. W. Bassett-Smith, Staff-Surgeon R.N., F.Z.S., F.R.M.S.

[Received March 1, 1899.]

(Plate XXVI.)

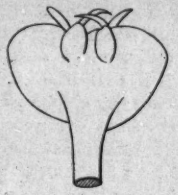
The number of known Copepoda parasitic upon fishes has been gradually increasing of late years: and their peculiar modes of life, extraordinary forms, and the remarkable positions in which they are found have caused them to be an interesting study to those naturalists who are working in marine zoology, especially if they have been in the habit of handling fishes when recently caught.

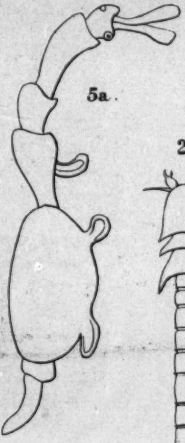
From a morphological point of view the lower types are the more interesting, as exemplifying the effect of parasitism on the females, which lose more and more their ordinary appendages, becoming nothing better than fixed saccular animals, capable of imbibing nourishment and producing progeny; while the male, though often of very minute size, retains its general crustacean appearance. These points have repeatedly been investigated by Carl Vogt, Kurz, Claus, and others.

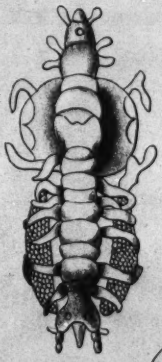
The literature on the subject is widely scattered, and many of the animals have exceedingly long lists of synonyms. It has been my object in this paper, which I trust will be of use to future workers, to gather together this material, and to put it into a workable form, as a basis for further investigation.

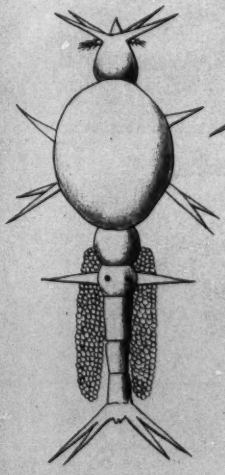
The latest attempt to systematize this group was made by A. Gerstäcker in Bronn's 'Class. und Ordn. des Thier-reichs,' 1866–1879, Crustacea, vol. v., Copepoda, which admirable work I have followed very closely, excepting in some groups which are mentioned later on. He has very largely based his classification on the structure of the articulate organs, which appears to be the most certain and scientific method. As the more lowly organized groups are reached, viz., those in which the female has lost almost all its articulate appendages, the characters and conformation of the males become most valuable guides: these being often very minute or pigmy-like. In many cases they are quite unknown, and are therefore a good field for further work, the discovery of new forms being very pleasing. There is no doubt that continued research, especially on the non-edible fish, in different parts of the world, would be rewarded by the discovery of a great number of new forms, and, what is badly wanted, further specimens to establish genera, many of which have been recorded by a single observer only, and not infrequently from one specimen only.

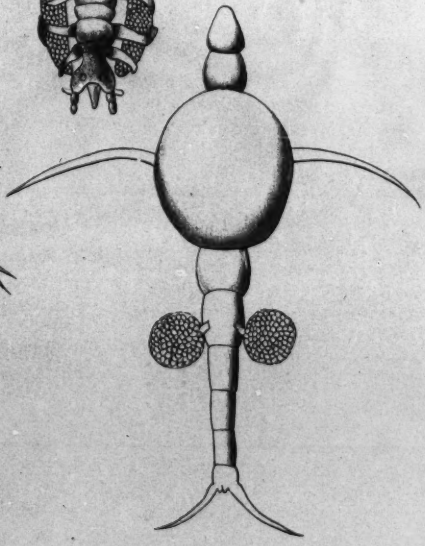
In a large number of cases the descriptions and plates found in the older works are most indefinite, making the diagnosis of the











P.W.B.S. del. R.E. Mintern lith.

Mintern Bros. imp.

PARASITIC COPEPODA.

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species referred to at the time very doubtful. Those, however, of Nordmann, Steenstrup & Lütken, Kröyer, and Heller, besides those in many monographs which have appeared since, are beautiful records of patient investigation, the latest being by Thomson in 1889, from specimens taken in waters near New Zealand. Some of the errors that have been made are very remarkable. Gesner in his 'Historia Animalium, de aquatilibus,' 1658, states that a parasite, which he calls *Asilus marinus*, "is found on the Tunny and Swordfish, and is so small as to be easily overlooked, it being seldom to be seen except at the rising of the dog-star." He gives a figure: it is what is now known as *Brachiella thynni*, and was mentioned by Aristotle, Pliny, and Rondeletius. Strom, a long time ago, mistook the tail for the head of a *Caligus*, and the egg-tubes for antennæ. De Blainville thought the eye of a Sprat was the head of *Lernæenicus sprattæ*; and more recently M. P. Van Beneden (as Carl Vogt has pointed out) has described the *Lepesphile* of Hesse as an Isopod.

The frequency with which some of these parasites are protected from their enemies by being covered with adventitious growths, especially those which, from their degenerate form, have become most fixed, is noteworthy. The Lernæas often have the body (which is soft, and generally of a reddish colour, from the hæmic fluid inside, and therefore not bad food for small fish) covered with a growth of algæ and sertularians, &c., quite masking their character; these, in one specimen in the British Museum, are so long as to resemble the real processes of *Lernæolophus*, and not until examined with a lens was their true nature detected. The body-portion of *Sphyrion* is often entirely hidden with this secondary parasitic growth, and as they themselves are furnished with hard processes, like bunches of calcareous algæ, they become very inconspicuous when in the water.

The bodies of *Lernæenicus* are pale yellow, with green external thread-like ovarian tubes. Most of the small scale-like *Caligidæ* found on the exterior of the fish are extremely difficult to detect, the larger members of this family being hidden under the fins or in the branchial cavities; but never have I seen so great a disproportion in the size of the parasite to the cavity as is sometimes the case with Isopods.

After a very considerable experience in examining fishes, several convictions are forced upon me: (1) that almost all fishes are infested with one or more species of parasite; (2) that as a rule these parasites are peculiar to them, though the difficulty of knowing when they are only varieties or distinct species always dogs one's steps in making a classification; (3) also that, as C. Vogt remarks, they may be divided into those which are blood-suckers and those which are mucus-eaters. A few specimens have been found free, taken in tow-nets when searching for Plankton; one species of *Caligus* has been taken on a Nautilus, but the genera commonly found in Tunicates and other invertebrates are not treated here.

The young attached condition of some of the Caligidæ has been

well demonstrated by Hesse; and the very interesting metamorphosis that the *Lernæa branchialis* goes through before becoming a fixed inert sac has been beautifully worked out by C. Claus, who has shown that copulation takes place when the animals are of very small size, the maturity of the ovules keeping pace with the increased growth of the female. The young unattached forms of this species have been taken in the tow-net by Mr. I. C. Thompson on more than one occasion; the juvenile conditions of other genera have been taken free, having been described as *Baculus* and *Hersellia*, which are probably the young of *Penella*.

In the family Ergasilidæ (p. 441), the genus *Thersites* Pagenst. does not appear to me to be distinct from *Ergasilus*, the only species of the former having been described from the gills of *Gasterosteus aculeatus*, from which, too, a species of the latter genus is taken; I have therefore united them together.

In the family Caligidæ (p. 444), the number of described species of *Caligus* is very large, and some of them have undoubtedly been known by many names; these I have endeavoured to place in their proper places. The genus *Papulina* of Van Beneden has been relegated to *Lepeophtheirus*, from which it has no marked differences; his genus *Calina* has been established, but the specimen described by him as *Caligeria* belongs to the old-formed genus *Alebion* of Kröyer. The *Lepeophtheirus huttoni* of Thomson, taken in New Zealand, a specimen of which he has been good enough to send me, should be placed with *Gloiopotes* Stp. & Lütk. Examples of the same species are present (unnamed) in the British Museum, taken at Madras. The genus *Nogagus* has been entirely left out, as it contains only male forms of other genera. The name *Perissopus* has been retained for Dana's *Lepidopus*, which is already in use, and Van Beneden's *Chlamys* is of more recent origin.

In the family Dichelestiidæ (p. 468), the genus *Epachthes* has been kept for a single species described by Nordmann, though the generic differences of this from *Lernanthropus* are very doubtful. Two new genera described by me in 1898 (*Cybicola* and *Pseudoclavella*) have been added.

The family Philichthyidæ (p. 477) has been formed to include all those parasites which are found only in the mucous canals and sinuses of various fish, and are so constructed as to be able to move freely in these spaces, the female having neither articulate limbs nor strong organs of attachment; the male is, however, of a distinct and rather high crustacean type. The first form found was the *Philichthys xiphiæ*, Stp.; it was placed in the last-mentioned family, though the female resembled much a *Chondracanthus*. Hesse was the first to discover the minute forms, which he divided into two genera, *Lepeophile* and *Colobomatus*. Since then Richiardi has described eight species of *Philichthys*, but they differ so much from the original that I have made for them a new genus, giving to it his name. Hesse, Richiardi, and Carl Vogt were strongly of opinion that these peculiar animals were worthy of being formed into a family of their own, especially as the known males are much alike and distinct.

In the family Lernæidæ, I have united the two genera *Lernæenicus* and *Lernæonema* under the older name, following the views set forth in the able paper by Richiardi in 1876. Five genera of this family are represented by single species.

In the family Chondracanthidæ (p. 488), the older name of *Sphyrion* has been retained for Kröyer's *Lesteira*. Two species are given, specimens of both being now in the British Museum—one, the larger (by far the largest of all these Copepod parasites), is from New Zealand, and is probably of the same species as that obtained by Guérin off the Cape of Good Hope, having few lobed processes on the float-like head. The second was taken off Dungeness; it is much smaller, with a greater number of lobe-like processes, and is described as *S. lumpi* Kr.

The position of the long known *Chondracanthus triglæ* has been for many years a disputed point. Linnæus placed it with the Lernæas; Blainville described it as a *Lernentoma*, Milne-Edwards as a *Chondracanthus*, Heller thought it probably a species of *Medesicate*, and J. Steenstrup placed it between *Lesteira* and *Medesicate*. The animal differs from every other, except *Therodamus*, in having the anterior part of the head with the hook-like posterior antennæ separated by a long neck-like process from the mouth, which is placed at the juncture of this with the thoracic portion—a peculiarity pointed out by Milne-Edwards and others, differing thus from *Medesicate* and *Chondracanthus*; I have therefore placed it in a genus of its own—*Oralien*.

In the family Lernæopodidæ, as I have pointed out before, it is impossible to differentiate the genus *Brachiella* from *Anchorella* by the female alone, the union, complete or otherwise, of the second pair of maxillipeds not being characteristic, though the males are quite distinct, and should be always looked for and recorded. Many of the *Anchorellæ* are very superficially described, and are very indefinite. The genus *Thysanote* has been made to embrace a number of peculiar forms which have been placed with *Brachiella*.

The genus *Cestopoda* of Kurz has been added. While in India I obtained on two occasions specimens of this peculiar genus from different fishes; these have not yet been described. I have provisionally placed here the *Naobranchia cygniformis* of Hesse, but it is insufficiently described.

Family I. ERGASILIDÆ.

Cephalothorax pyriform or flattened, first segment the largest; nearly or wholly provided with limbs. Anterior antennæ of moderate length, 5- or 6-jointed, alike in both sexes. Posterior antennæ with 3 or 4 joints. Second maxillipeds in the form of hooks, generally 3-jointed. Fifth pair of thoracic limbs one-branched or sometimes rudimentary. Eye median, with two lenses. Sex-organs paired. Female with two egg-sacs. Young as a free-swimming larva. Male smaller than female and less freely locomotive.

G. 1. Bomolochus Nordm.

Cephalothorax rounded in front; segments rapidly decreasing in size. Anterior antennæ with enlarged and densely-bristled basal joints. Mouth-organs placed close behind the antennæ. Posterior antennæ 2- or 3-jointed, not unciform at the end. First four thoracic limbs biramose, triarticulate, setiferous; fifth pair uniramose, biarticulate. Abdomen 3- or 4-jointed, provided with two caudal plates. Male small, resembling the female, but with delicately plumose anterior antennæ.

(1) Bomolochus gracilis. ♀.

Bomolochus gracilis Heller, Reise d. Novara, 1865, p. 157, pl. xiii. fig. 3.

Host: gills of *Zygæna malleus*, from Java.

(2) Bomolochus belones. ♀.

Bomolochus belones Burmeister, Abhandl. Kais. Leopoldinischen Akademie, 1835, vol. xvii. p. 300.

„ „ M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 479.

Host: gills of *Esox belone* [Belone vulgaris][1].

(3) Bomolochus ardeolæ. ♀.

Bomolochus ardeolæ Kr. Bidrag til Kundskab, 1863, p. 220, pl. xi. fig. 3.

Host: gills of *Belone ardeola*. New Orleans.

(4) Bomolochus chatoëssi. ♀.

Bomolochus chatoessi Kr. Bidrag til Kundskab, 1863, p. 214, pl. xi. fig. 5.

Host: gills of *Chatoëssus* sp. East Indies.

(5) Bomolochus tetrodontis. ♀.

Bomolochus tetradonis B.-S. Ann. & Mag. N. H. ser. 7, vol. i. 1898, p. 4, pl. i. fig. 2.

Host: gills of *Tetrodon oblongus*. Bombay.

(6) Bomolochus scomberesocis. ♀.

Bomolochus scomberesocis Kr. Bidrag til Kundskab, 1863, p. 217, pl. x. fig. 5.

Host: *Scomber esox*. Atlantic.

(7) Bomolochus megaceros. ♀ ♂.

Bomolochus megaceros Heller, Reise d. Novara, 1865, p. 153, pl. xiii. fig. 3.

„ „ B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 51, pl. x. fig. 1.

In Coll. Brit. Mus.

Hosts: *Stromateus niger* and *Caranx djeddaba*. East Indies.

[1] The names of the fishes printed in italics are those used by the authors in the papers quoted. Synonyms added in square brackets are those adopted by Günther in the British Museum Catalogue of Fishes.

(8) Bomolochus triceros. ♀.

Bomolochus triceros B.-S. Ann. & Mag. N. H. ser. 7, vol. i. 1898, p. 2, pl. i. fig. 1.
In Coll. Brit. Mus.
Host: gills of *Stromateus cinereus*. Bombay.

(9) Bomolochus denticulatus. ♀.

Bomolochus denticulatus B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 78, pl. iii. fig. 1.
Hosts: gills of *Sphyræna jello* and *Hemirhamphus far* [H. commersonii]. Ceylon.

(10) Bomolochus glyphisodontis. ♀.

Bomolochus glyphisodontis Kr. Bidrag til Kundskab, 1863, p. 223, pl. xi. fig. 4.
Host: gills of *Glyphisodon saxatilis*. Nicaragua.

(11) Bomolochus parvulus. ♀.

Bomolochus parvulus Nordm. Mikrog. Beiträge, 1832, p. 135.
Host: gills of *Amphacanthus rivulatus*.

(12) Bomolochus cornutus. ♀.

Bomolochus cornutus Claus.
Host: *Astrodermus coryphænoides* [Diana semilunata].

(13) Bomolochus soleæ. ♀.

Bomolochus solea Claus.
Host: *Pleuronectes solea* [Solea vulgaris].

G. 2. Ergasilus Nordm.

Cephalothorax elongated, with five distinct segments, first large. Anterior antennæ 6-jointed, setaceous. Posterior antennæ triarticulate, very long, arm-like; mouth placed some distance behind these. First four pairs of thoracic limbs biramose, triarticulate, setiferous; fifth pair aborted or uniramose. Abdomen consisting of three joints, terminating in caudal plates provided with long bristles.

(1) Ergasilus sieboldi. ♂.

Ergasilus sieboldii Nordm. Mikrog. Beiträge, 1832, p. 15, pl. ii. fig. 1.
„ „ Kr. Bidrag til Kundskab, 1863, p. 237, pl. xiii. fig. 2.
„ „ M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 478.
„ „ C. Claus, Neue Beiträge, parasit. Copepoda, 1875, pl. xiii. fig. 12.
Hosts: gills of *Cyprinus carpio*, *Esox lucius*, *Silurus glanis*.

(2) ERGASILUS TRISETACEUS. ♀.

Ergasilus trisetaceus Nordm. Mikrog. Beiträge, 1832, p. 16, pl. iii. fig. 7.
" " M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 478.
Host: gills of *Silurus glanis*.

(3) ERGASILUS GIBBUS. ♂.

Ergasilus gibbus Nordm. Mikrog. Beiträge, 1832, p. 16, pl. iii. fig. 1.
" " M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 478.
Host: gills of *Anguilla vulgaris*.

(4) ERGASILUS LONGIMANUS. ♂.

Ergasilus longimanus Kr. Bidrag til Kundskab, 1863, p. 231, pl. xiii. fig. 1.
Host: gills of *Mugil* sp. Brazil.

(5) ERGASILUS FUNDULI. ♀.

Ergasilus funduli Kr. Bidrag til Kundskab, 1863, p. 228, pl. xi. fig. 1.
Host: gills of *Fundulus limbatus*. New Orleans.

(6) ERGASILUS LABRACIS. ♀.

Ergasilus labracis Kr. Bidrag til Kundskab, 1863, p. 229, pl. xi. fig. 2.
Host: gills of *Labrax lineatus*. West Indies.

(7) ERGASILUS LIZÆ. ♂.

Ergasilus lizæ Kr. Bidrag til Kundskab, 1863, p. 232.
Host: gills of *Mugil liza*. New Orleans.

(8) ERGASILUS PEREGRINUS. ♀.

Ergasilus peregrinus Heller, Reise d. Novara, 1865, p. 152 pl. xiii. fig. 1.
Host: gills of *Perca chuatsi*. Shanghai.

(9) ERGASILUS GASTEROSTEI. ♀.

Ergasilus gasterostei Kr. Bidrag til Kundskab, 1863, p. 233, pl. xii. fig. 2.
Thersites " Pagenst. Archiv f. Natur. 1860, p. 120, pl. v. fig. 8.
Host: gills of *Gasterosteus aculeatus*. Norway.

Family II. CALIGIDÆ.

Carapace broad, compressed. Cephalothorax incompletely provided with limbs, the free thoracic segments frequently overlapped or hidden by paired dorsal plates. Anterior antennæ short, with two or three joints. Posterior antennæ in the form of an articulate

hooked claw, not extending beyond the carapace. Mouth as a more or less elongated suctorial beak, formed out of the upper and lower lip, in which is seen the slender mandible. Maxillipeds free, both in the form of hooks, the posterior being the most powerful; the first four pairs of thoracic limbs mostly biramose, but not infrequently the first and fourth uniramose, fifth pair rudimentary. Eye median, simple, frequently suppressed. Generative organs paired. External ovaries as two cord-like tubes. Male generally smaller than female; both sexes in the young of some genera attached by a slender frontal filament.

DIVISION i. *Caliginæ*.—Terminal joints of most of the thoracic limbs fringed with plumose hairs.

G. 1. HERMILIUS Heller.

Carapace deeply notched in the centre, the two halves folding together like the valves of a mussel. First and fourth pairs of thoracic limbs uniramose, second and third biramose. Fourth thoracic segment small, free, not provided with dorsal plates.

(1) HERMILIUS PYRIVENTRIS. ♀.

Hermilius pyriventris Heller, Reise d. Novara, 1865, p. 186, pl. xviii. fig. 1.

Host: gills of *Arius acutus* [A. argyropleuron]. Java.

(2) HERMILIUS LONGICORNIS. ♀.

Hermilius longicornis B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 30, pl. iii. fig. 2.

In Coll. Brit. Mus.

Host: *Arius acutirostris*. Trincomalee.

G. 2. PARAPETALUS Stp. & Lütk.

Carapace rounded, scutiform. Frontal border with lunulæ. First and fourth pairs of thoracic limbs uniramose, second and third biramose. Genital segment of large size, covered over by two dorsal plates; also with two elongated flattened processes projecting backwards from the posterior border and origin of abdominal portion; which latter is biarticulate, terminating in two small caudal plates.

(1) PARAPETALUS ORIENTALIS. ♀.

Parapetalus orientalis Stp. & Lütk. Bidrag til Kundskab, 1861, p. 365, pl. v. fig. 10.

Host: gills of *Mene maculata*. Indian Ocean.

G. 3. SYNESTIUS Stp. & Lütk.

Carapace rounded, scutiform. Frontal border with lunulæ. First and fourth thoracic limbs uniramose; second and third biramose. Genital segment large, not covered by dorsal plates, but prolonged

backwards on either side by two elongated blunted processes. Abdomen long, consisting of two joints terminating in two minute caudal plates.

(1) SYNESTIUS CALIGINUS. ♀.

Synestius caliginus Stp. & Lütk. Bidrag til Kundskab, 1861, p. 364, pl. vi. fig. 11.

Host: gills of *Stromateus paru* Bl. [S. niger]. Indian Ocean.

G. 4. CALIGODES Heller.

Carapace very small, rounded. Frontal border with minute lunulæ. First and fourth thoracic limbs uniramose; second and third biramose. Genital segment flask-shape, produced forwards as a long neck, posteriorly elongated into two divergent leaf-like processes. Abdomen large, broad, with two minute caudal plates.

(1) CALIGODES LACINIATUS. ♀.

Chondracanthus laciniatus Kllr.
Sciænophilus „ Kr. Bidrag til Kundskab, 1863, p. 153, pl. viii. fig. 3.
Caligodes „ Heller, Reise d. Novara, 1865, p. 180.

Host: *Belone* sp. Indian Ocean.

(2) CALIGODES CARANGIS. ♀.

Caligodes carangis B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 364, pl. xi. fig. 4.
In Coll. Brit. Mus.

Host: *Caranx ferdau*. Aden.

G. 5. CALIGUS Müller.

Carapace large, scutiform. Frontal border provided with lunulæ. First and fourth thoracic limbs uniramose; second and third biramose. Fourth thoracic segment free, small, without dorsal plates. Genital segment without plates or processes. Abdomen with two terminal caudal plates.

Division 1. Abdomen with single joint.

(1) CALIGUS ABBREVIATUS. ♀ ♂.

Caligus abbreviatus Kr. Bidrag til Kundskab, 1863, p. 61, pl. iii. fig. 4.

Host: *Labrus bergylta* [L. maculatus]. Bergen.

(2) CALIGUS PARVUS. ♀ ♂.

Caligus parvus B.-S. Ann. & Mag. N. H. ser. 7, vol. i. 1898, p. 5, pl. ii. fig. 1.
In Coll. Brit. Mus.

Host: gills of *Tetrodon oblongus*. Bombay.

(3) Caligus brevipedis. ♀.

Caligus brevipedis B.-S. Ann. & Mag. N. H. ser. 6, vol. xviii. 1896, p. 11, pl. iii. fig. 1.

Host: gills of *Motella tricirrata*. Plymouth.

(4) Caligus centrodonti. ♀ ♂.

Caligus centrodonti Baird, Brit. Entom. 1850, p. 272, pl. xxxii. figs. 6–7.

Host: *Pagellus centrodontus*. British seas.

(5) Caligus curtus. ♀ ♂.

Caligus curtus Müll. Entomostraca, 1785, p. 130, pl. xxi. fig. 1.
„ „ Kr. Tidsskrift, 1837, vol. i. p. 623, pl. vi. fig. 5.
„ „ Desmarest, Consid. sur les Crust. 1825, p. 340.
„ „ M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 451.
„ *mulleri* Leach, Encycl. Brit. Suppl. 1816, p. 405, pl. xx.
„ „ Desmarest, Consid. sur les Crust. 1825, p. 342, pl. l. fig. 4.
„ „ M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 450.
„ „ Baird, British Entom. 1850, p. 271, pl. xxxii. fig. 4.
„ *bicuspidatus* Nordm. Mikrog. Beiträge, 1832, p. 28.
„ *elegans*? V. Bened. Annal. de Scien. Nat. 3 ser. vol. xvi. 1851, p. 91.
„ *diaphanus* Baird, British Entom. 1840, p. 269, pl. xxxiii. fig. 1.
„ *americanus* Dana, Amer. Journ. of Sc. & Art, 1838, vol. xxxiv. pls. 3, 4, 5.
&c.

In Coll. Brit. Mus.

Hosts: *Gadidæ*, *Trigla* spp., *Rhombus maximus*, *Mugil* &c.

(6) Caligus æglefini. ♀ ♂.

Caligus æglefini Kr. Bidrag til Kundskab, 1863, p. 89, pl. vii. fig. 3.

Host: *Gadus æglefinus* Linn.

(7) Caligus minimus. ♀ ♂.

Caligus minimus Otto, Nov. Act. Acad. Cæs. Leop. 1828, vol. xiv. p. 354, pl. xxii. fig. 7.
„ *minutus* M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 450.
„ „ Heller, Reise d. Novara, 1865, p. 163.

In Coll. Brit. Mus.

Host: gills of *Labrax lupus*. European seas.

(8) Caligus nanus. ♀ ♂.

Caligus nanus Kr. Bidrag til Kundskab, 1863, p. 86, pl. ii. fig. 4.

Host:—?

(9) CALIGUS GURNARDI. ♀ ♂.

Caligus gurnardi Kr. Bidrag til Kundskab, 1863, p. 76, pl. ii. fig. 3.

Host: *Trigla gurnardus*. British seas.

(10) CALIGUS HÆMULONIS. ♀ ♂.

Caligus hæmulonis Kr. Bidrag til Kundskab, 1863, p. 48, pl. iv. fig. 3.

Host: *Hæmulon elegans*. West Indies.

(11) CALIGUS RAPAX. ♀ ♂.

Caligus rapax M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 453, pl. xxxviii. fig. 9.
„ „ Baird, Brit. Entom. 1850, p. 270, pl. xxxii. fig. 2.
„ „ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 359, pl. ii. fig. 4.
„ „ Kr. Bidrag til Kundskab, 1863, p. 71.
„ „ B.-S. Journ. M. B. Assn. Plymouth, 1896, p. 156.
„ *elongatus* Nordm. Mikrog. Beiträge, 1832, p. 24.
„ *leptochilus* Leuckart, in Frey und Leuckart, Beitrag, p. 165.

In Coll. Brit. Mus.

Hosts: *Gadidæ*, *Trigla*, *Pleuronectes*, *Zeus faber*, *Salmo*.

(12) CALIGUS LACUSTRIS. ♀.

Caligus lacustris Stp. & Lütk. Bidrag til Kundskab, 1861, p. 355, pl. i. fig. 2.

Hosts: *Leuciscus rutilus*, *Esox lucius*, *Perca fluviatilis*.

(13) CALIGUS BALISTÆ. ♀ ♂.

Caligus balistæ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 356, pl. i. fig. 1.

Host: *Balistes* sp. West Indies.

(14) CALIGUS KROEYERI. ♀.

Caligus kröyeri M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 452.
„ „ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 357.

In Coll. Brit. Mus.

Host: *Diodon* sp.

(15) CALIGUS TENAX. ♀ ♂.

Caligus tenax Heller, Reise d. Novara, 1865, p. 172, pl. xv. fig. 3.
„ „ B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 393, pl. xi. fig. 3.

In Coll. Brit. Mus.

Hosts: *Lobotes erate*, Java, and *Caranx* spp., Indian Ocean.

(16) Caligus carangis. ♀ ♂.

Caligus carangis Kr. Bidrag til Kundskab, 1863, p. 69, pl. v. fig. 2.
" " B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 364.
In Coll. Brit. Mus.
Host: *Caranx* sp. East Indies.

(17) Caligus trachynoti. ♀.

Caligus trachynoti Heller, Reise der Fregatte Novara, 1865, p. 169, pl. xv. fig. 1.
Host: gills of *Trachynotus* sp. Brazil.

(18) Caligus chilodactyli. ♀ ♂.

Caligus chilodactyli Kr. Bidrag til Kundskab, 1863, p. 52, p. iv. fig. 5.
Host: *Chilodactylus* sp. Valparaiso.

(19) Caligus lumpi. ♂.

Caligus lumpi Kr. Bidrag til Kundskab, 1863, p. 73, pl. ii. fig. 2.
Host: *Cyclopterus lumpus*. Europe.

(20) Caligus trachypteri. ♀.

Caligus trachypteri, Kr. Bidrag til Kundskab, 1863, p. 57, pl. iii. fig. 1.
Host: *Trachypterus* sp. Mediterranean.

(21) Caligus stromatei. ♀ ♂.

Caligus stromatei Kr. Bidrag til Kundskab, 1863, p. 43, pl. iv. fig. 1.
Host: *Stromateus* sp. East Indies.

(22) Caligus alalongæ. ♂.

Caligus alalonga Kr. Bidrag til Kundskab, 1863, p. 55, pl. iv. fig. 6.
Host: gills of *Thynnus alalonga* Cuv.

(23) Caligus phipsoni. ♀ ♂.

Caligus phipsoni B.-S. Ann. & Mag. N. H. ser. 7, vol. i. 1898, p. 7, pl. iii. fig. 3.
In Coll. Brit. Mus.
Host: *Cybium guttatum*. Bombay.

(24) Caligus belones. ♀.

Caligus belones Kr. Bidrag til Kundskab, 1863, p. 81, pl. vii. fig. 1.
Host: *Raja batis*?

(25) CALIGUS MURRAYANUS. ♂.

Caligus murrayanus T. Scott, Tr. Linn. Soc., Zool. vol. vi. 1895, p. 129, pl. xiv. fig. 20.

Host:— ? Gulf of Guinea.

(26) CALIGUS DUBIUS. ♀.

Caligus dubius T. Scott, Tr. Linn. Soc., Zool. vol. vi. 1895, p. 130, pl. xiv. fig. 22.

Host:— ? Gulf of Guinea.

(27) CALIGUS PLATYTARSI. ♀.

Caligus platytarsis B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 83, pl. iv. fig. 2.

In Coll. Brit. Mus.

Host: gills of *Mugil* sp. Muscat.

(28) CALIGUS ISONYX. ♀.

Caligus isonyx Stp. & Lütk. Bidrag til Kundskab, 1861, p. 358, pl. iii. fig. 5.

Host: gills of *Sphyræna baracuda* [S. picuda]. West Indies.

(29) CALIGUS DAKERI. ♀.

Caligus dakeri V. Ben. Bull. Acad. Roy. Belg. vol. xxiii. 1892, p. 243, pl. i. fig. 1.

Host:— ?

(30) CALIGUS SCOMBERI. ♀.

Caligus scomberi B.-S. Ann. & Mag. N. H. vol. xviii. 1896, p. 11, pl. iii. fig. 2.

In Coll. Brit. Mus.

Host: gills of *Scomber scomber*. Plymouth.

(31) CALIGUS MONACANTHI. ♀.

Caligus monacanthi Kr. Bidrag til Kundskab, 1863, p. 59, pl. iii. fig. 2.

Host: *Monacanthus* sp. West Indies.

(32) CALIGUS HIRSUTUS. ♀ ♂.

Caligus hirsutus B.-S. Ann. & Mag. N. H. ser. 7, vol. i. 1898, p. 6, pl. iii. fig. 1.

In Coll. Brit. Mus.

Host: gills of *Polynemus tetradactylus*. Bombay.

Division 2. Abdomen articulate, 2-jointed.

(33) CALIGUS VEXATOR. ♀.

Caligus vexator Heller, Reise d. Novara, 1865, p. 165, pl. xiv. fig. 2.

Host: gills of *Dentex vulgaris*. Mediterranean.

(34) CALIGUS INFESTANS. ♀ ♂.

Caligus infestans Heller, Reise d. Novara, 1865, p. 167, pl. xiv. figs. 3, 4.

„ „ B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 360.

Hosts: gills of *Scomber* sp., and *Cybium commersoni*. Indian Ocean.

(35) CALIGUS CHORINEMI. ♀.

Caligus chorinemi Kllr. Mus. Cæs. Wien. (vide Heller).

„ „ Kr. Bidrag til Kundskab, 1863, p. 67, pl. v. fig. 1.

„ „ Heller, Reise der Fregatte Novara, 1865, p. 174, pl. xv. fig. 4.

Host: gills of *Chorinemus saliens*. Brazil.

(36) CALIGUS FALLAX. ♀.

Caligus fallax Kr. Bidrag til Kundskab, 1863, p. 92, pl. xvii. fig. 3.

Host:— ?

(37) CALIGUS CORYPHÆNÆ. ♀ ♂.

Caligus coryphænæ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 360, pl. iv. fig. 7.

„ *bengoensis* Scott, Entomostr. G. of Guinea, Trans. Linn. Soc., Zool. vi. 1895, p. 130, pl. xiv. fig. 19.

„ *thynni*? Dana, Expl. Exp. U.S., Crust. ii. 1854.

„ *scutatus*? M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 453.

Host: *Coryphæna* sp. East Indies.

(38) CALIGUS TORPEDINIS.

Caligus torpedinis Heller, Reise d. Novara, 1865, p. 176, pl. xv. fig. 6.

Host: gills of *Torpedo* sp. Indian Ocean.

(39) CALIGUS ROBUSTUS. ♀ ♂.

Caligus robustus B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 361, pl. xi. fig. 1.

In Coll. Brit. Mus.

Host: gills of *Caranx* spp. Indian Ocean.

(40) CALIGUS COSSACKI. ♀ ♂.

Caligus cossackii B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 85, pl. iv. fig. 3.

„ *constrictus*? ♂, Heller, Reise d. Novara, 1865, p. 175, pl. xv. fig. 5.

In Coll. Brit. Mus.

Host: gills of *Chrysophrys sarba* and *Stromateus*. Indian Ocean.

(41) CALIGUS LONGIPES. ♀ ♂.

Caligus longipedis B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 359, pl. x. fig. 2.

Host: gills of *Caranx melampygus*. Aden.

(42) CALIGUS CYBII. ♀.

Caligus cybii B.-S. Ann. & Mag. N. H. ser. 7, vol. i. 1898, p. 6, pl. ii. fig. 3.

In Coll. Brit. Mus.

Host: *Cybium lineolatum*. Bombay.

(43) CALIGUS DIAPHANUS. ♀.

Caligus diaphanus Nordm. Mikrog. Beiträge, ii. 1832, p. 26.
" " Kröyer, Bidrag til Kundskab, 1863, p. 79, pl. vii. fig. 5.
" " B.-S. Journ. M. B. Assn. Plymouth, 1896.

In Coll. Brit. Mus.

Not Baird, not M.-E.

Host: gills of *Trigla* spp. British seas.

(44) CALIGUS ARII. ♀.

Caligus arii B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 82, pl. iv. fig. 1.

In Coll. Brit. Mus.

Host: gills of *Arius acutirostris*. Trincomalee.

(45) CALIGUS IRRITANS. ♀ ♂.

Caligus irritans Heller, Reise d. Novara, 1865, p. 177, pl. xv. fig. 7.

In Coll. Brit. Mus.

Hosts: gills of *Serranus*, Brazil (Heller); *Caranx*, East Indies (B.-S.).

(46) CALIGUS PELAMYDIS. ♀.

Caligus pelamydis Kr. Bidrag til Kundskab, 1863, p. 50, pl. iv. fig. 4.

Host: gills of *Pelamys sarda*.

(47) CALIGUS PRODUCTUS. ♀.

Caligus productus Dana, Expl. Exp. U.S., Crust. ii. 1854, pl. xc. fig. 4.
" " ? Kr. Bidrag til Kundskab, 1863, p. 64, pl. iii. fig. 4.
" " Stp. & Lütk. Bidrag til Kundskab, 1868, p. 357, pl. iii. fig. 6.

Not Müller.

Hosts: *Coryphæna* and *Balistes*. West Indies.

(48) CALIGUS TRICHIURI. (♂ Kr., ♀ B.-S.)

♂. *Caligus trichiuri* Kr. Bidrag til Kundskab, 1863, p. 46, pl. iv. fig. 2*e*

Host: *Trichiurus haumela*. East Indies.

♀ (?). *Caligus longicaudus* B.-S. Ann. & Mag. N. H. ser. 7, vol. i. 1898, p. 8, pl. iv. fig. 1.

In Coll. Brit. Mus.

Hosts: *Trichiurus haumela* and *Chirocentrus dorab*. Bombay.

Division 3. Abdomen with 3 joints.

(49) CALIGUS ANGUSTATUS. ♀.

Caligus angustatus Kr. Bidrag til Kundskab, 1863, p. 84, pl. vii. fig. 2.

Sub-G. SCIÆNOPHILUS Van Beneden.

Cephalothorax proportionally very small, rounded. Genital segment elongated. Abdomen having a total length equal to the remainder. Second maxillipeds very large, massive; other limbs as in *Caligus*.

(1) SCIÆNOPHILUS TENUIS. ♀.

Sciænophilus tenuis V. Ben. Bull. Acad. Roy. Belg. xix. 1852, pt. 3, p. 464.
„ „ V. Ben. Recherch. sur les Crust. Belg. 1861, p. 148, fig. xxi.
„ „ B.-S. Journ. M. B. Assn. Plymouth, 1896, p. 156.

In Coll. Brit. Mus.

Host: gills of *Sciæna aquila*. Europe.

(2) SCIÆNOPHILUS BENEDENI. ♀.

Sciænophilus benedeni B.-S. Ann. & Mag. N.H. ser. 7, vol. i. 1898, p. 9, pl. iv. fig. 3.

Host: gills of *Sciæna diacanthus*. Bombay.

G. 6. LEPEOPHTHEIRUS Nordm.

Carapace large, rounded, scutiform. Frontal border without lunulæ. Fourth thoracic segment small, simple. Genital segment without plates or lobes. Abdomen projecting, terminating in two caudal plates. Thoracic limbs as in *Caligus*.

Division 1. Abdomen consisting of a single joint.

(1) LEPEOPHTHEIRUS BRACHYURUS. ♀.

Lepeophtheirus brachyurus Heller, Reise d. Novara, 1865, p. 185, pl. xvi. fig. 4.

Host: gills of *Tetrodon calamaria* [T. stellatus]. Java.

(2) LEPEOPHTHEIRUS COSSYPHI. ♀.

Lepeophtheirus cossyphi Kr. Bidrag til Kundskab, 1863, p. 115, pl. vii. fig. 6.

Host: gills of *Cossyphus bodjanus* [C. rufus].

(3) LEPEOPHTHEIRUS ROTUNDIVENTRIS. ♀ ♂.

Lepeophtheirus rotundiventris B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 86, pl. v. fig. 1.

Hosts: gills of *Lutjanus* sp. and *Serranus* sp. Indian Ocean.

(4) LEPEOPHTHEIRUS SUHMI. ♀.

Lepeophtheirus suhmi Brady, Challenger, viii. p. 132, pl. lv. fig. 2.

Host: *Scarus* sp. St. Vincent, Cape Verde Is.

(5) LEPEOPHTHEIRUS PECTORALIS. ♀ ♂.

Lernea pectoralis Müll. Zool. Dan. 1776, p. 41, pl. xxxiii. fig. 7.
Caligus pectoralis Kr. Tidsskrift, ii. 1838, p. 8, pl. vi. fig. 4.
„ „ M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 454.
„ „ Thompson, Ann. & Mag. N. H. ser. 1, vol. xx. 1847, p. 247.
Lepeophtheirus pectoralis Nordm. Mikrog. Beiträge, ii. 1832, p. 30.
„ „ Baird, Brit. Entom. 1850, p. 275, pl. xxxii. fig. 10
„ „ B.-S. Jour. M. B. Assn. Plymouth, 1896, p. 158.

In Coll. Brit. Mus.

Hosts: gills of *Pleuronectidæ* and *Scomber scomber*. Europe.

(6) LEPEOPHTHEIRUS NORDMANNI. ♀ ♂.

Lepeophtheirus nordmannii M.-E. Hist. Nat. Crust. iii. 1840, p. 455.
„ „ Heller, Reise d. Novara, 1865, p. 180, pl. xvi. fig. 1.
Caligus nordmannii Atlas, Règne An. de Cuv., édit. Crochart, pl. lxxvii. fig. 1.
„ „ Thompson, Ann. & Mag. N. H. ser. 1, vol. xx. 1847, p. 248.

Host: *Orthagoriscus mola*.

(7) LEPEOPHTHEIRUS HIPPOGLOSSI. ♀ ♂.

Caligus hippoglossi Kr. Bidrag til Kundskab, 1863, p. 131, pl. vi. fig. 5.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 456.
Lepeophtheirus hippoglossi Baird, Brit. Entom. 1850, p. 276, pl. xxxii. fig. 12.
Binoculus piscinus? Fabr. Fauna Grœnlandica, 1780, p. 239.

In Coll. Brit. Mus.

Host: *Hippoglossus maximus* [H. vulgaris]. North Sea, &c.

(8) LEPEOPHTHEIRUS ORNATUS. ♀.

Caligus ornatus M.-E. Hist. Nat. Crust. vol. iii. 1840, p. 455.
" " Nordm. Coll. du Mus. du jard. du Roi (vide Milne-Edwards).

Host :—? Valparaiso.

(9) LEPEOPHTHEIRUS THOMPSONI. ♂ ♀.

Lepeophtheirus thompsoni Baird, Brit. Entom. 1850, p. 278, pl. xxx. fig. 2.
" *gracilis*, V. Ben. Ann. de Scien. Nat. vol. xvi. 1851, p. 90, pl. ii.

In Coll. Brit. Mus.
Host : gills of *Rhombus maximus*. British seas.

(10) LEPEOPHTHEIRUS STROMI. ♀ ♂.

Lepeophtheirus stromii Baird, Trans. Berwick. Nat. Club, 1847.
" " Baird, Brit. Entom. 1850, p. 174, pl. xxxii. fig. 8.
" " B.-S. Jour. M. B. Assn. 1896, p. 157.
Laxe lusis Ström, Kjöbenh. Selsk. Skrift. x. p. 23, pl. vii. fig. 1.
Caligus vesper? M.-E. Hist. Nat. Crust. iii. 1840, p. 456.
" *salmonis* Kr. Bidrag til Kundskab, 1863, p. 137, pl. xvii. fig. 1.
" " Stp. & Lütk. Bidrag til Kundskab, 1861, p. 355.

In Coll. Brit. Mus.
Host : *Salmo* spp.

(11) LEPEOPHTHEIRUS POLLACHII. ♀ ♂.

Lepeophtheirus pollachius B.-S. Ann. & Mag. N. H. ser. 6, vol. xviii. 1896, p. 12, fig. 1.

In Coll. Brit. Mus.
Hosts : *Gadus pollachius* and *Molva vulgaris*. Plymouth.

(12) LEPEOPHTHEIRUS STURIONIS. ♀.

Lepeophtheirus sturionis Kr. Tidskrift, i. 1837, pl. vi. fig. 6.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 457.
" " Stp. & Lütk. Bidrag til Kund. 1861, p. 355.

In Coll. Brit. Mus.
Host : *Acipenser sturio*.

(13) LEPEOPHTHEIRUS FLORESI. ♀.

Pupulina flores V. Beneden, Bull. Acad. Roy. Belg. vol. xxiv. 1892, p. 254, pl. iii.

Host : *Ceratopterus* sp. Azores.

(14) LEPEOPHTHEIRUS ERICHSONI. ♀ ♂.

Lepeophtheirus erichsoni Thomson. Trans. N. Z. Inst. vol. xxiii. 1890, p. 227, pl. xxiii.

Host : *Latris ciliaris*. New Zealand.

Division 2. Abdomen with two articulations.

(15) LEPEOPHTHEIRUS INTERCURRENS. ♀ ♂.

Lepeophtheirus intercurrens Kr. Bidrag til Kundskab, 1863, p. 126, pl. v. fig. 4.

Host:—?

(16) LEPEOPHTHEIRUS CRABRO. ♀ ♂.

Lepeophtheirus crabro Kr. Bidrag til Kundskab, 1863, p. 129, pl. vi. fig. 3.

Host:—? North Sea.

(17) LEPEOPHTHEIRUS ROBUSTUS. ♀.

Lepeophtheirus robustus Kr. Bidrag til Kundskab, 1863, p. 135, pl. vi. fig. 6.

Host: gills of *Raja* sp. Greenland.

(18) LEPEOPHTHEIRUS QUADRATUS. ♀.

Lepeophtheirus quadratus Kr. Bidrag til Kundskab, 1863, p. 113, pl. vii. fig. 7.

Host: *Bagrus* sp. China.

(19) LEPEOPHTHEIRUS MONACANTHUS. ♀.

Lepeophtheirus monacanthus Heller, Reise d. Fregatte Novara, 1865, p. 183, pl. xvi. fig. 3.

Host: gills of *Pimelodus* sp. Brazil.

(20) LEPEOPHTHEIRUS GROHMANNI. ♀.

Lepeophtheirus grohmanni Kr. Bidrag til Kundskab, 1863, p. 108, pl. v. fig. 3.

Host: *Pleuronectes* [*Arnoglossus*] *grohmanni*. Mediterranean.

(21) LEPEOPHTHEIRUS BRANCHIALIS. ♀ ♂.

Caligus branchialis Malm. MSS.
„ „ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 362, pl. ii. fig. 3.
Lepeophtheirus rhombi Kr. Bidrag til Kundskab, 1863, p. 118, pl. v. fig. 5.

Host: gills of *Rhombus maximus*.

(22) LEPEOPHTHEIRUS OBSCURUS. ♂ ♀.

Lepeophtheirus obscurus Baird, Brit. Entom. 1850, p. 277, pl. xxxii. fig. 11.
„ „ ? B.-S. Jour. M. B. Assn. Plymouth, 1896, p. 157.
(*Caligus*) „ B.-S. Ann. & Mag. N. H. ser. 6, vol. xviii. 1896, pl. iv. fig. 2.

In Coll. Brit. Mus.

Host: *Rhombus lævis*. Plymouth.

(23) LEPEOPHTHEIRUS GIBBUS. ♀.

Lepeophtheirus gibbus Kr. Bidrag til Kundskab, 1863, p. 121, pl. xvii. fig. 2.

Host: *Pleuronectes rhombus* [Rhombus lævis].

(24) LEPEOPHTHEIRUS LONGIPALPUS. ♀.

Lepeophtheirus longipalpus B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 88, pl. v. fig. 2.

Host: *Arius acutirostris*. Trincomalee.

(25) LEPEOPHTHEIRUS GRACILESCENS. ♀.

Lepeophtheirus gracilescens Kr. Bidrag til Kundskab, 1863, p. 124, pl. v. fig. 2.

Host: *Rhombus vulgaris* [Rhombus lævis].

(26) LEPEOPHTHEIRUS BAGRI. ♀ ♂.

Lepeophtheirus bagri Dana, Proc. Amer. Acad. Arts & Sc. ii. 1848, p. 57.

Host: *Bagrus* sp. Rio de Janeiro.

G. 7. ANURETES Heller.

Carapace rounded as in last genus. First and fourth thoracic limbs uniramose, second and third biramose, rudiments of fifth pair well represented. Genital segment rounded, cut away posteriorly. Abdomen hidden or with caudal plates only slightly projecting.

(1) ANURETES HECKELI. ♀.

Caligus heckelii Kllr.

Lepeophtheirus heckelii Kr. Bidrag til Kundskab, 1863, p. 110, pl. vii. fig. 4.

Anuretes heckelii Heller, Reise d. Novara, 1865, p. 186.

Host: gills of *Ephippus gigas*. Brazil.

(2) ANURETES PERPLEXUS. ♀.

Anuretes perplexus B.-S. Ann. & Mag. N. H. 1898, ser. 7, vol. ii. p. 89, pl. v. fig. 3.

In Coll. Brit. Mus.

Host: gills of *Lutjanus* sp. Ceylon.

G. 8. CALINA Van Beneden.

Carapace large, oval, scutiform. Frontal plates well marked, no lunulæ. Fourth thoracic segment free, without dorsal plates. Genital segment rounded, with two horny dentate processes directed backwards as in *Pandarus*. Abdomen indistinctly biarticulate. First three pairs of thoracic limbs biramose, fourth uniramose, both branches of the first with two joints, those of the second and third with three.

(1) CALINA BRACHYURA. ♀.

Calina brachyura V. Ben. Bull. Acad. Roy. Belg. vol. xxiv. 1892, p. 249, pl. ii.

Host: skin of *Ceratopterus* sp. Azores.

G. 9. GLOIOPOTES Stp. & Lütk.

Carapace large, oval, scutiform. No lunulæ on the frontal border. Fourth thoracic segment with two dorsal plates partly covering the genital segment, the latter being produced backwards by two elongated curved processes having a styliform appendage projecting from the outer border, serrated at the edge. Abdomen long. Caudal plates lanciform. First and fourth thoracic limbs single-branched, second and third double.

(1) GLOIOPOTES HYGOMIANUS. ♀.

Gloiopotes hygomianus Stp. & Lütk. Bidrag til Kundskab, 1861, p. 363, pl. v. fig. 9.

Host:—? Atlantic.

(2) GLOIOPOTES HUTTONI. ♀ ♂.

Lepeophtheirus huttoni Thomson, Trans. N. Z. Inst. 1889, vol. xxii. p. 354, pl xxviii. fig. 10, *a–c*; xxix.

In Coll. Brit. Mus.

Hosts: *Histiophorus herschelii*, New Zealand, and *H.* sp., Madras.

G. 10. LUETKENIA Claus. (*Cecropsina* Heller.)

Carapace short, obcordate. No frontal plates. Anterior antennæ biarticulate. Fourth thoracic ring covered by small dorsal plates. Genital segment prolonged backwards as lobes. Abdomen short, not articulate, terminating with two small caudal plates. First pair of thoracic limbs uniramose, second and third biramose, biarticulate, fourth biramose, each branch with a single joint; setæ minute.

(1) LUETKENIA ASTRODERMI. ♀.

Lütkenia astrodermi Claus.

Host: *Astrodermus* sp. [Diana sp.]. Mediterranean.

(2) LUETKENIA GLABRA. ♀ ♂.

Cecropsina glabra Heller, Reise d. Novara, 1865, p. 209, pl. xix. fig. 1.

In Coll. Brit. Mus.

Host:—? Mediterranean.

G. 11. NESSIPUS Heller.

Carapace broad. First two free rings of the thorax distinctly

articulate and lobed laterally. Frontal plates conspicuous. Anterior antennæ biarticulate. Posterior antennæ uniform, with a spur on base of the terminal joints. Rostrum elongated; palp articulated; second maxilliped with short toothed end-claw. Fourth thoracic ring without dorsal plates. Genital segment elongated. Abdomen short. Caudal plates small, with plumose setæ. All the thoracic limbs biramose, first three biarticulate, fourth uniarticulate.

(1) NESSIPUS ORIENTALIS.

Nessipus orientalis Heller, Reise d. Novara, 1865, p. 194, pl. xviii. fig. 2.

Host: gills of *Prionodon menisorrah*. Java.

(2) NESSIPUS CRYPTURUS.

Nessipus crypturus Heller, Reise d. Novara, 1865, p. 196, pl. xviii. fig. 4.

Host: gills of *Zygæna malleus*. Java.

NOGAGUS Leach.

Only male forms of this genus have been described, which have been divided into two groups by Steenstrup and Lütken, and by Gerstäcker—(1) Those in which the fourth pair of thoracic limbs are biramose and biarticulate, like the first three pairs, and also having the abdomen with two joints. (2) Those in which the fourth pair are biramose, but with only a single joint, the first three being biramose and biarticulate; abdomen of a single joint. The first are in many cases proved to be the male forms of various species of *Pandarus*; the second are most probably the males of species of *Nessipus*, *Demoleus*, *Ecthrogaleus*, and *Dinematura*. I have here enumerated the species which have so far been described, but as a distinct genus *Nogagus* should not appear.

When taking these parasites from Sharks, among specimens of *Pandarus*, some of the male forms are almost invariably found. As has been pointed out by Thomson, the amount of pigment in them varies very considerably, from almost black to light yellow; but no observations have been made as to whether the lighter forms are mostly found on the white undersurface of the fish, and the dark forms above, a point which would be interesting to elucidate.

The *Nogagus angustatus* represented by Van Beneden[1] with a male attached would appear to be a species of *Dysgamus*, though the characters of the thoracic limbs are incompletely described, and poorly shown in the plates.

DIVISION I.

Nogagus latreillii Leach, Dict. des Sci. Nat. vol. xiv. p. 536 (1819).
„ *grandis* Stp. & Lütk. Bidrag til Kundskab, 1861, p. 338, pl. x. fig. 1.

[1] Bull. Acad. Roy. Belg. vol. xxiv. 1892, p. 245, pl. i.

Nogagus errans? Kr. Bidrag til Kundskab, 1863, p. 175, pl. x. fig. 3.
„ *braccatus* Heller, Reise d. Novara, 1865, p. 177, pl. xx. fig. 3.
„ *angustulus* Gerst. Arch. f. Naturg. xx. pt. 1, 1854, p. 192.
„ *validus* Dana, Proc. Amer. Acad. Arts & Sc. ii. 1852, p. 58.

Division II.

Nogagus elongatus Heller, Reise d. Novara, 1865, p. 206, pl. xx. fig. 5.
„ *cœlebs* Heller, op. cit. p. 208, pl. xx. fig. 4.
„ *borealis* Stp. & Lütk. Bidrag til Kundskab, 1861, p. 387, pl. xi. fig. 21.
„ *tenax* Stp. & Lütk. op. cit. 1861, p. 388, pl. x. fig. 20.
„ *brevicaudatus* M.-E. Hist. Nat. Crust. iii. 1840, p. 460.
„ *gracilis* Burm. Acta Acad. Cæs.-Leop. vol. xvii. p. 284, pl. xxiii. fig. 1.
„ *lunatus* Stp. & Lütk. op. cit. 1861, p. 389, pl. ix. fig. 7.

G. 12. Demoleus Heller.

Carapace rounded. Frontal plates distinct. Anterior antennæ two-jointed. The first free thoracic joints lobed laterally, second without lobes, third prolonged backwards by two dorsal plates. Genital segment elongated. Abdomen small. Caudal plates very distinct. All four pairs of thoracic limbs biramose and biarticulate.

(1) Demoleus paradoxus. ♀ ♂.

Caligus paradoxus Otto, Acta Acad. Cæs. Leop. 1828, vol. xiv. p. 352, pl. xxii. fig. 5.
„ „ Nordm. Mikrog. Beiträge, 1832, p. 32.
„ „ Gerst. Arch. zur Naturg. 1853, xix. i. pl. iv. fig. 1.
„ *productus*? Müller, Entomostraca, 1785.
Nogagus grandis? ♂, vide Heller, op. cit. p. 202.
Host: "Dog-fish." Mediterranean.

G. 13. Dysgamus Stp. & Lütk.

Carapace large, rounded. Frontal lobes distinct. Anterior antennæ biarticulate. Rostrum long; palp articulate. Fourth thoracic joint free, without dorsal plates. Genital segment obcordate. Abdomen biarticulate, with small caudal plates. All four thoracic limbs biramose and biarticulate. This genus was made by Steenstrup from a male only; but in the Coll. Brit. Mus. there are a large number of specimens, some with external ovaries attached, which I have examined and have no doubt of their identity: therefore the genus is allowed to stand.

(1) DYSGAMUS ATLANTICUS. ♀ ♂.

Dysgamus atlanticus Stp. & Lütk. Bidrag til Kundskab, 1861, p. 368, pl. iv. fig. 8.

In Coll. Brit. Mus.

Host: "Shark." Atlantic and Indian Oceans.

G. 14. EURYPHORUS Nordm.

Carapace small, rounded. Frontal plates distinct. Fourth thoracic segment with two small dorsal plates. Genital segment large, oval, with two minute posterior lobes. Abdomen biarticulate, very elongated, spreading widely outwards and backwards as lamellar appendages. Caudal plates small. First pair of thoracic limbs biramose, biarticulate; second and third biramose, triarticulate; fourth biramose, the outer with three, the inner with two joints.

(1) EURYPHORUS NORDMANNI. ♀.

Euryphorus nordmannii M.-E. Hist. Nat. Crust. iii. 1840, p. 462, pl. xxxix. fig. 1.

Host:— ? Waters of Asia.

(2) EURYPHORUS NYMPHA. ♀ ♂.

Euryphorus nympha Stp. & Lütk. Bidrag til Kundskab, 1861, p. 366, pl. vi. fig. 12.

„ *coryphænæ* ♂ Kr. Bidrag til Kundskab, 1863, p. 161, pl. x. fig. 4.

Host: *Lampugus punctulatus* [Coryphæna punctulata] and *Coryphæna hippurus*. Atlantic.

G. 15. TREBIUS Kr.

Carapace oval, large. Frontal plates distinct. Anterior antennæ biarticulate. Third and fourth thoracic segments free, without dorsal plates. Genital segment short and broad. Abdomen long, simple. Thoracic limbs all with two branches, those of the first with two joints each, those of the second, third, and fourth triarticulate.

(1) TREBIUS CAUDATUS. ♀.

Trebius caudatus Kr. Tidsskrift, ii. 1838, p. 30, pl. i. fig. 4.

„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 458.

„ „ Thompson, Ann. & Mag. N. H. xx. p. 248 (1847).

„ „ Baird, Brit. Entom. 1850, p. 280, pl. xxxiii. fig. 3.

„ *spinifrons* ? M.-E. Hist. Nat. Crust. iii. 1840, p. 458, pl. xxxviii. fig. 1.

„ *caudatus* Kr. Bidrag til Kundskab, 1863, p. 149, pl. x. fig. 1.

In Coll. Brit. Mus.

Hosts: *Raja* sp., *Galeus vulgaris* [G. canis], &c.

(2) TREBIUS TENUIFURCATUS. ♀.

Trebius tenuifurcatus Rath. Proc. U.S. Nat. Hist. Mus. 1887, x. p. 559.

Host: *Trygon* sp. Atlantic.

G. 16. ELYTROPHORA Gerst.

Carapace rounded. Frontal plates distinct. Anterior antennæ two-jointed. Fourth thoracic segment with two dorsal plates. Genital segment large, lobed posteriorly. Caudal plates large. All four pairs of thoracic limbs biramose, the branches of the first biarticulate, of the second and third triarticulate, the fourth having the outer branch with three joints, the inner with two.

(1) ELYTROPHORA BRACHYPTERA. ♀ ♂.

Elytrophora brachyptera Gerst. Arch. f. Naturg. 1853, xix. p. 60, pl. iii. fig. 12.
" " Heller, Reise d. Novara, 1865, p. 189, pl. xvii. fig. 1.
" " B.-S. Ann. & Mag. N. H. ser. 6, xviii. 1896, p. 12, pl. iv. fig. 3.

Dinematura thynni Kollar.

Arneus thynni Kr. Bidrag til Kundskab, 1863, p. 157, pl. viii. fig. 5.

Caligeria bella? Dana, Proc. Amer. Acad. Arts & Sc. 1848, p. 57.

In Coll. Brit. Mus.

Host: gills of *Thynnus* spp. European waters.

G. 17. ALEBION Kr.

Carapace large, oval. Frontal plates well marked. Anterior antennæ two-jointed. Fourth thoracic segment with small dorsal plates. Genital segment broad, prolonged backwards in two elongated processes with the ends and outer margins dentate. Abdomen biarticulate. Caudal plates with long setæ. The first three pairs of thoracic limbs biramose, with lunate corneous bodies on outer branches; fourth pair of limbs quite rudimentary, hidden.

(1) ALEBION CARCHARIÆ. ♀ ♂.

Alebion carchariæ Kr. Bidrag til Kundskab, 1863, p. 165, pl. xii. fig. 1.
" " B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 367, pl. xii. fig. 1.

Host: Shark? Atlantic and Indian Oceans.

(2) ALEBION DIFFICILE. ♀.

Caligeria difficilis V. Ben. Bull. Acad. Roy. Belg. xxiv. 1892, p. 258, pl. iv.

Host:—? Azores.

G. 18. Dinematura Latreille.

Carapace rounded, deeply excavated posteriorly. Frontal plate distinct. Anterior antennæ biarticulate. Rostrum long. Second maxillipeds massive and nodose. First free thoracic segment with a small lateral lobe; second of a square shape, free; third with two large dorsal plates. Genital segment oblong, winged, posteriorly produced in two short lobes and a small median process, partially covered by two narrow plates. Abdomen elongated, with lateral processes and two large foliaceous caudal appendages. All the thoracic limbs are biramose, the first biarticulate, the second and third triarticulate, all with plumose hairs on the margin; the fourth pair are changed into lamellar processes.

(1) Dinematura producta. ♀.

Caligus productus Müll. Entomost. 1785, p. 132, pl. xxi. fig. 3.
Pandarus lamnæ Johnst. Mag. Nat. Hist. 1835, viii. p. 203.
Dinemoura lamnæ Baird, Brit. Entom. 1850, p. 286, pl. xxxv. fig. 7.
Dinematura producta Stp. & Lütk. Bidrag til Kundskab, 1861, p. 34, pl. vii. fig. 13.
„ *lamna* Kr. Bidrag til Kundskab, 1863, p. 179.
Dinematoura elongata V. Bened. Bull. Ac. Roy. Belg. 1860, p. 149, pl. xxiv.
„ „ ♂ V. Bened. Bull. Ac. Roy. Belg. 1892, p. 231.
In Coll. Brit. Mus.
Hosts: *Lamna cornubica*; *Scymnus glacialis* [Læmargus borealis].

(2) Dinematura ferox. ♀.

Dinematura ferox Kr. Tidsskrift, ii. 1838, p. 40, pl. i. fig. 5.
Dinemoura ferox M.-E. Hist. Nat. Crust. iii. 1840, p. 465.
„ „ Stp. & Lütk. Bidrag til Kund. 1861, p. 379.
Dinematura carcharodonte Thomson, Trans. N. Z. Inst. 1889, vol. xxii. p. 360, pl. xxvi. fig. 2.
In Coll. Brit. Mus.
Host: *Scymnus microcephalus* [Læmargus borealis].

(3) Dinematura serrata. ♀.

Dinemoura serrata Kr. Bidrag til Kundskab, 1863, p. 176, pl. viii. fig. 4.
Host:—?

(4) Dinematura latifolia. ♀.

Dinematura latifolia Stp. & Lütk. Bidrag til Kundskab, 1861, p. 38, pl. viii. fig. 16.
In Coll. Brit. Mus.
Host: *Oxyrhina* [Lamna] *glauca*.

(5) Dinematura hamiltoni. ♀.

Dinematura hamiltoni Thomson, Trans. N. Z. Inst. vol. xxii. 1889, p. 357, pl. xxv. fig. 1.
Host: "Shark." New Zealand.

G. 19. ECHTHROGALEUS Stp. & Lütk.

Carapace as in *Dinematura*. Dorsal plates of last thoracic ring proportionally larger; no median processes posteriorly to genital segment; abdomen and caudal plates not projecting. Thoracic limbs as in the preceding genus, except that the inner branch of the second and third pairs has only two joints instead of three.

(1) ECHTHROGALEUS COLEOPTRATUS. ♂ ♀.

Dinemoura coleoptratus Guérin, Icon. d. Règ. animal, iii. 1817, pl. xxxv. fig. 6.
Pandarus alatus Johnst. Loud. Mag. Nat. Hist. viii. 1836, p. 202.
Dinemoura alata M.-E. Hist. Nat. Crust. iii. 1840, p. 464.
„ „ Baird, British Entom. 1850, p. 285, pl. xxxiii. fig. 8.
Nogagus? ♂.
Echthrogaleus coleoptratus Stp. & Lütk. Bidrag til Kundskab, 1861, p. 380, pl. viii. fig. 15.
In Coll. Brit. Mus.
Host: *Lamna cornubica*.

(2) ECHTHROGALEUS NEO-ZEALANICUS. ♀.

Dinematura neozealanica Thomson, Trans. N. Z. Inst. 1839, vol. xxii. p. 359, pl. xxv. fig. 2.
Host: "Shark." New Zealand.

(3) ECHTHROGALEUS AFFINIS. ♀ ♂.

Dinemoura affinis M.-E. Hist. Nat. Crust. iii. 1840, p. 465, pl. xxxviii. fig. 15.
„ „ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 382.
Dinematura braccata Dana, U.S. Expl. Exp., Crust. ii. 1848, p. 1370, pl. 95. fig. 4.
Nogagus braccata ♂, Heller, Reise d. Novara, 1865, p. 197, pl. xx. fig. 3.
In Coll. Brit. Mus.
Host: *Leptocarcharias* sp. New Zealand and Tongatabu.

(4) ECHTHROGALEUS INDISTINCTUS. ♀.

Dinematura indistincta Kr. Bidrag til Kundskab, 1863, p. 183.
Host:—? Valparaiso.

DIVISION ii. *Pandarinæ*.—All the limbs provided with hook-like appendages, or with the edges quite smooth.

G. 20. CECROPS Leach.

Carapace oval, robust, deeply notched in front. Anterior antennæ small, hidden. Last thoracic segment with a pair of short dorsal plates. Genital segment as long as cephalothorax. Abdomen small. Caudal plates minute. All the thoracic limbs biramose, increasing

in size from first to fourth; terminal joints of all with short hook-like setæ. External ovaries long, thread-like, twisted, concealed.

(1) CECROPS LATREILLII. ♀ ♂.

Cecrops latreillii Leach, Ency. Brit. Supp. i. 1816, pl. xx. figs. 1–5.
" " Lamarck, Anim. s. Vert. ed. i. t. 138, 1818.
" " Latreille, Encycl. méth. pl. 335, fig. 3–9.
" " Desmarest, Cons. sur les Crust. 1825, 338, pl. l. fig. 2.
" " Guérin. Icon. Règne An., Crust. 1817, pl. xxxv. fig. 8.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 474.
" " Baird, Brit. Entom. 1850, p. 293, pl. xxxiv. fig. 1.
" " Nordm. Mikrog. Beiträge, 1832, p. 39.
" " Kröyer, Bidrag til Kundskab, 1863, p. 190.
" " V. Bened. Rech. sur la faun. lit. Belg. 1861, p. 149, pl. xx.
" " Thomson, Trans. N. Z. Inst. vol. xxii. 1889.

In Coll. Brit. Mus.

Host: *Orthagoriscus mola*. Mediterranean.

G. 21. PHYLLOPHORUS M.-E.

Carapace cordiform. Anterior antennæ projecting, triarticulate. Rostrum long. Thorax with three broad, spreading, overlapping plates. Genital segment rounded. Abdomen with short lateral blunt processes on either side of its base. All the limbs biramose and lamellar, without bristles or hooks.

(1) PHYLLOPHORUS CORNUTUS. ♀.

Phyllophorus cornutus M.-E. Hist. Nat. Crust. iii. 1840, p. 471, pl. xxxviii. fig. 13.

Host:—? Tongatabu.

G. 22. GANGLIOPUS Gerst.

Carapace broader in front than behind, not deeply notched in the centre. Anterior antennæ free, biarticulate; first maxillipeds unciform. Three free thoracic segments with large dorsal plates, the first with the inner margins widely separated, those of the 2nd and 3rd with the inner borders approximated. All four pairs of thoracic limbs biramose, the first having the outer branch with one, inner with two joints, those of the second and third both two-jointed, the fourth single-jointed.

(1) GANGLIOPUS PYRIFORMIS. ♀ ♂.

Gangliopus pyriformis Gerst. Arch. für Naturg. xx. 1854, p. 192, pl. i. fig. 9.

Nogagus curticaudatus ♂, Dana? vide Stp. & Lütk., Bidrag til Kund. 1861, p. 390.

Host:—? Atlantic.

G. 23. PANDARUS Leach.

Carapace broader behind than in front, not deeply notched. Anterior antennæ free, biarticulate; first maxilliped with a double end-claw; three pairs of small dorsal plates, first placed laterally, second and third median. Genital segment terminating in two minute points, and at the base of the abdomen are two lateral sharp dentate appendages. Thoracic limbs as in *Gangliopus*.

(1) PANDARUS BICOLOR. ♀.

Pandarus bicolor Leach, Encycl. Brit. Supp. i. 1816, p. 405, pl. xx. fig. 5.
„ „ Desmarest, Cons. sur les Crust. 1825, p. 339, pl. v. fig. 5.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 470.
„ „ Burm. Nov. Act. Acad. Nat. Cur. 1831, xviii. p. 331.
„ „ Kröyer, Bidrag til Kundskab, 1863, p. 187.
„ „ Baird, Brit. Entom. 1850, p. 288, pl. xxx. fig. 10.
„ „ B.-S. Journ. M. B. Assn. 1896, p. 156.
„ *bosci* Leach, Encycl. Brit. Supp. i. 1816, p. 406, pl. xx. fig. 1.
„ „ Baird, Brit. Entom. 1850, p. 289.
„ *fissifrons* M.-E. ? Hist. Nat. Crust. iii. 1840, p. 470.

In Coll. Brit. Mus.

Hosts: *Squalus* [Leuciscus] spp.; *Carcharias glaucus*; *Scyllium catulus*.

(2) PANDARUS DENTATUS. ♀ ♂.

Pandarus dentatus M.-E. Hist. Nat. Crust. iii. 1840, p. 469, pl. xxxviii. fig. 19.
„ *pallidus* ? M.-E. Hist. Nat. Crust. iii. 1840, p. 468.
Nogagus elongatus ? Heller, Reise d. Novara, 1865, p. 206, pl. xx. fig. 5.

In Coll. Brit. Mus.

Hosts: "Sharks." Indian and Pacific Oceans.

(3) PANDARUS CARCHARIÆ. ♀ ♂.

Pandarus carchariæ Leach, Dict. de Scien. Nat. 1819, vol. xiv. p. 535.
„ „ Desmarest, Cons. sur les Crust. 1825, p. 339.
„ „ Burm. Nov. Act. Acad. Nat. 1833.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 469.
„ *vulgaris* M.-E. op. cit. p. 469.
„ *cranchii* Leach, Dict. des Scien. Nat. vol. xiv. p. 535.
„ „ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 390, pl. xi. fig. 22.
Nogagus cranchii ♂, V. Beneden, Bull. Acad. Roy. Belg. xxiii. 1892, p. 221.

In Coll. Brit. Mus.

Host: *Carcharias* spp. Atlantic and Indian Oceans.

(4) PANDARUS ARMATUS. ♀ ♂.

Pandarus armatus Heller, Reise d. Novara, 1865, p. 202, pl. xix. fig. 4.
„ „ Thoms. Trans. N. Z. Inst. vol. xxii. 1889.
Nogagus latreillii ♂, M.-E. Hist. Nat. Crust. iii. 1840, p. 459.
„ „ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 384, pl. ix. fig. 18.
In Coll. Brit. Mus.
Host: *Scyllium africanum*. Cape of Good Hope.

(5) PANDARUS LUGUBRIS. ♀.

Pandarus lugubris Heller, Reise d. Novara, 1865, p. 205, pl. xx. fig. 1.
Host: "Shark." Mediterranean.

(6) PANDARUS ZYGÆNÆ. ♀.

Pandarus zygæna Brady, Challenger Rep. vol. viii. pl. lv. fig. 3.
Host: *Zygæna malleus*. Cape de Verde Is.

(7) PANDARUS AFFINIS. ♀ ♂.

Pandarus affinis V. Bened. Bull. Ac. Roy. Belg. xxiii. 1892, p. 224.
Host: *Squalus* sp. Senegal.
Pandarus brevicaudatus Dana, Proc. Am. Acad. Arts & Sc. 1848, p. 59.
„ *satyrus*, id. ibid.
„ *cocinnatus*, id. ibid.
From "Sharks" in the Pacific Ocean: imperfectly described.

G. 24. LÆMARGUS Kr.

Carapace cordiform. Anterior antennæ triarticulate. Two narrow free articulate thoracic segments, followed by two pairs of large spreading dorsal plates, united in the middle line, covering the genital segment and abdomen. All the thoracic limbs biramose, lamellar, without setæ or hooks.

(1) LÆMARGUS MURICATUS Kr. ♀.

Læmargus muricatus Kr. Tidsskrift, 1837, p. 487, pl. v.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 475, pl. xxxix. fig. 2.
„ „ V. Bened. Recher. sur les Crust. Belg. 1861, p. 149, pl. xix. fig. 1.
In Coll. Brit. Mus.
Host: *Orthagoriscus mola*. Pacific.

G. 25. PERISSOPUS Stp. & Lütk. (*Lepidopus* D na; *Chlamys* V. Ben.)

Carapace broad, produced backwards laterally. Anterior antennæ very small, biarticulate. Three pairs of dorsal plates, the first

placed laterally, the second small, central; third pair large, spreading. Genital segment as large as the cephalothorax. Abdomen small, hidden. Thoracic limbs very rudimentary.

(1) PERISSOPUS DENTATUS. ♀.

Perissopus dentatus Stp. & Lütk. Bidrag til Kundskab, 1861, p. 393, pl. xii. fig. 25.

„ *communis* Rath. Proc. U.S. N. H. Mus. 1887, x. p. 560.

Hosts: *Carcharias* sp. and *C. obscurus*.

(2) PERISSOPUS ARMATUS. ♀.

Lepidopus armatus Dana, Proc. Am. Acad. Arts & Sc. 1843, p. 60.

Perissopus armatus Stp. & Lütk. Bidrag til Kundskab, 1861, p. 394.

Host: *Mustelus vulgaris*. Rio Janeiro.

(3) PERISSOPUS INCISUS. ♀.

Chlamys incisus V. Ben. Bull. Acad. Roy. Belg. 1892, p. 227, pl. ii. fig. 1.

Host:—? Bay of Dakar, Senegal.

Family III. DICHELESTIIDÆ.

The body is as a rule elongated, and the head small. The free thoracic segments are simple (only exceptionally seen with dorsal plates). Abdomen generally rudimentary. The anterior antennæ are slender, mostly with many joints up to 15, rarely short with only 2 or 3 joints. Posterior antennæ unciform or cheliform, generally projecting beyond the border of the cephalothorax. Mouth-parts as in *Caligidæ*. Generally there are four pairs of thoracic limbs, frequently short, stump-like, or suppressed, or the posterior ones transformed into lamellar plates. Eye single, median, or absent. Genital organs as in *Caligidæ*. Male and female only relatively different. The majority are capable of a certain amount of locomotion.

G. 1. ANTHOSOMA Leach.

Head oval, infolding, broadest posteriorly. Two distinct dorsal thoracic plates, and three pairs of large overlapping ones which represent the limbs. Abdominal segment small, terminating in two long caudal appendages. Anterior antennæ long, multi-articulate. Posterior antennæ unciform, very large, and projecting. Rostrum elongated.

(1) ANTHOSOMA CRASSUM. ♀.

Caligus crassus Abgd. Mém. de Copenhag. 1794.

„ *imbricatus* Risso, Hist. Nat. Crust. Nice, 1816, p. 162, pl. iii. fig. 13.

Anthosoma smithii Baird, Brit. Entom. 1850, p. 299, pl. xxxiii. fig. 9.
„ „ Leach, Enc. Brit. Suppl. 1816, p. 406, pl. xx. fig. 1.
„ „ Kröyer, Tidsskrift, ii. 1838, p. 295, pl. ii. fig. 2.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 483, pl. xxxix. fig. 5.
„ *crassus*, Stp. & Lütk. Bidrag til Kundskab, 1861, p. 397, pl. xxii. fig. 24.

In Coll. Brit. Mus.

Host: *Lamna cornubica*. Pacific and Atlantic, &c.

G. 2. TUCCA Nordm.

Head small, rounded, with a lamellar appendage on either side; neck distinct. No dorsal plates on thoracic limbs. Genital segment large, oval. Abdomen small, biarticulate. Anterior antennæ many-jointed, setaceous. Posterior antennæ small, unciform.

(1) TUCCA IMPRESSA. ♀.

Tucca impressa Nordm. Bull. Soc. Imp. Moscou, vol. xxxvii. pl. vi. fig. 7 (1864).
„ „ Kr. Tidsskrift, i. 1837, p. 182.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 496.

Host: *Diodon hystrix*. Atlantic.

G. 3. NORION Nordm.

Head rounded, small; neck distinct. No dorsal thoracic plates, limbs converted into a divided ventral plate with wing-like expansions anteriorly.

(1) NORION EXPANSUS. ♀.

Norion expansus Nordm. Bull. Soc. Imp. Moscou, vol. xxxvii. pl. ii. (1864).

Host:—?

G. 4. EPACHTHES Nordm.

Cephalothorax as in *Lernanthropus*, the first pair of thoracic limbs being short, single-branched with three joints, the last three changed into lamellar plates.

(1) EPACHTHES PARADOXUS. ♀.

Epachthes paradoxus Nordm. Mikrogr. Beiträge, 1832, p. 45, pl. xii. fig. 2.
Lernanthropus paradoxus M.-E. Hist. Nat. Crust. iii. 1840, p. 499.

Host: *Mugil* sp. Cape of Good Hope.

G. 5. LERNANTHROPUS Nordm.

Head oblong or pyriform, sides incurved; neck distinct. Thorax two-jointed, produced posteriorly in a lobe or a pair of lobes more

or less completely covering the genital segment, abdomen, and appendages. The abdomen articulate, ending in two small caudal non-setiferous plates. Anterior antennæ always 5- or 6-jointed. Posterior antennæ strong, unciform. Rostrum long. The first two thoracic limbs are biramose and rudimentary, the third and fourth converted into lamellar appendages. Male smaller than the female and without large posterior lobes.

(1) LERNANTHROPUS MUSCA. ♀.

Lernanthropus musca Blainv. Journ. de Physique, 1823, vol. xcv. p. 404. fig. 14.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 498, pl. xli. fig. 2.

Host: *Diodon* sp. Manila.

(2) LERNANTHROPUS PUPA. ♀.

Lernanthropus pupa Burm. Journ. de Physique, 1823, vol. xcv. p. 303, pl. xxiv. fig. 7.

Host: gills of *Platax*. Brazil.

(3) LERNANTHROPUS TEMMINCKI. ♀.

Lernanthropus temminckii Nordm. Bull. Soc. Imp. Moscou, 1864, xxxvii. pl. ii.

Host: gills of *Saurus lacerta* [Scombresox saurus]. Ostend.

(4) LERNANTHROPUS KOENIGII. ♀ ♂.

Lernanthropus königii Stp. & Lütk. Bidrag til Kundskab, 1861, p. 395, pl. xii. fig. 23.

Hosts: gills of *Stromateus paru* [S. niger], *Cymothoa eremita*, &c.

(5) LERNANTHROPUS CARANGIS. ♀.

Lernanthropus carangis Hesse, Ext. de la Rev. de Scien. Nat. ii. 1878, pl. i.

Host: *Caranx* sp. Europe.

(6) LERNANTHROPUS BELONES. ♀.

Lernanthropus belones Kr. Bidrag til Kundskab, 1863, p. 205, pl. ix. fig. 4.

Host: gills of *Belone almeida* [B. truncata]. Brazil.

(7) LERNANTHROPUS ANGULATUS. ♀ ♂.

Lernanthropus angulatus Kr. Bidrag til Kundskab, 1863, p. 196, pl. ix. fig. 1.

Host: gills of *Serranus* sp.

(8) LERNANTHROPUS SCRIBÆ. ♀.

Lernanthropus scribæ Kr. Bidrag til Kundskab, 1863, p. 203, pl. ix. fig. 3.

Lernanthropus trigonocephalus Heller, Reise d. Novara, 1865, p. 226, pl. xxii. fig. 3.

Host: gills of *Serranus scriba*. Mediterranean.

(9) LERNANTHROPUS LATIVENTRIS. ♀ ♂.

Lernanthropus lativentris Heller, Reise d. Novara, 1865, p. 223, pl. xxi. fig. 4.

Host: gills of *Mesoprion phaiotæniatus* [M. vitta]. Java.

(10) LERNANTHROPUS LARVATUS. ♀ ♂.

Lernanthropus larvatus Heller, Reise d. Novara, 1865, p. 227, pl. xxii. fig. 4.

Host: gills of *Priacanthus ocellatus*. Indian Ocean.

(11) LERNANTHROPUS PERCIS. ♀.

Lernanthropus percis Thomson, Trans. N. Z. Inst. xxii. 1889, p. 366, pl. xxvii. fig. 2.

Host: gills of *Percis colias*. New Zealand.

(12) LERNANTHROPUS PAGELLI. ♀ ♂.

Lernanthropus pagelli Kr. Bidrag til Kundskab, 1863, p. 200, pl. ix. fig. 2.

Host: gills of *Pagellus penna* [? Chrysophrys calamus].

(13) LERNANTHROPUS ATROX. ♂ ♀.

Lernanthropus atrox Heller, Reise d. Novara, 1865, p. 221, pl. xxi. fig. 3.

„ „ B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 91, pl. vi. fig. 3.

Hosts: gills of *Pagrus guttulatus* [P. unicolor], N. Holland, and *Chrysophrys sarba*, Persian Gulf.

(14) LERNANTHROPUS PAGODUS. ♀.

Lernanthropus pagodus Kr. Bidrag til Kundskab, 1863, p. 208, pl. viii. fig. 2.

Host: gills of *Eques balteatus* [E. lanceolatus]. Brazil.

(15) LERNANTHROPUS TRIFOLIATUS. ♀.

Lernanthropus trifoliatus B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 12, pl. vii. fig. 3.

Host: gills of *Polynemus tetradactylus*. Bombay.

(16) LERNANTHROPUS KROEYERI. ♀ ♂.

Lernanthropus kröyeri V. Ben. Ann. Sc. Nat. 3 ser. vol. xvi. 1851, p. 102, pl. iii.

„ „ Claus, Beitrag Parasit. Crust. 1858, p. 18, pl. ii. fig. 16.

„ „ Nordm. Bull. Soc. Imp. Moscou, 1864, pl. xxxviii. fig. 5.

Lernanthropus kröyeri Hesse, Ext. de la Rev. de Sc. Nat. 1878, vol. vii.
„ „ B.-S. Journ. M. B. Assn. Plymouth, 1896, p. 159.
In Coll. Brit. Mus.
Host: gills of *Labrax lupus*. European seas.

(17) LERNANTHROPUS BREVOORTIÆ. ♀.

Lernanthropus brevoortiæ Rath. Proc. U.S. N. H. Soc. 1887, x. p. 563.
Host: gills of *Brevoorta* [Clupea] *tyrannus*. Atlantic.

(18) LERNANTHROPUS POMATOMI. ♀ ♂.

Lernanthropus pomatomi Rath. Proc. U.S. N. H. Soc. 1887, x. p. 567.
Host: *Pomatomus saltator*? Atlantic.

(19) LERNANTHROPUS NOBILIS. ♀.

Lernanthropus nobilis Heller, Reise d. Novara, 1865, p. 225, pl. xxii. fig. 2.
Host: gills of *Temnodon saltator*. Brazil.

(20) LERNANTHROPUS GISLERI. ♂ ♀.

Lernanthropus gisleri V. Ben. Bull. Acad. Roy. Belg. vol. xix. no. 9. 1861, pl. xxxviii.
„ „ Hesse, Revue des Sc. Nat. vi. 1877, pl. iv.
Host: *Sciæna aquila*. European seas.

(21) LERNANTHROPUS GIGANTEUS. ♀ ♂.

Lernanthropus giganteus Kr. Bidrag til Kundskab, 1863, p. 206, pl. viii. fig. 1.
„ „ B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 360.
Host: gills of *Caranx* spp. Indian Ocean.

(22) LERNANTHROPUS NUDUS. ♀ ♂.

Lernanthropus nudus B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 368, pl. xii. fig. 2.
In Coll. Brit. Mus.
Host: gills of *Mugil* sp. Aden.

(23) LERNANTHROPUS PETERSI. ♀ ♂ (*Stalagmus*).

Lernanthropus petersi Nordm. Bull. Soc. Imp. N. Moscou, 1864, pl. viii. fig. 1.
Host: gills of *Serranus goliath*. Mozambique.

See also *Lernanthropus holmbergi* Nordm. Bull. Soc. Imp. N. Moscou, 1864, from Honolulu. Male only described.

G. 6. Dichelestium Herm.

Head obtuse. Body elongated, consisting of four distinctly articulated segments, without dorsal plates. Genital segment oval, long. Abdomen oblong, with two minute caudal plates. Anterior antennæ slender, with 8 joints. Posterior antennæ large, cheliform at the end. The first two pairs of thoracic limbs small, two-branched, the third lamellar, the fourth suppressed.

(1) Dichelestium sturionis. ♀ ♂.

Dichelestium sturionis Herm. Mém. Aptérologique, 1804, p. 125, pl. v. fig. 5.
" " Nordm. Mikrogr. Beiträge, 1832, p. 41.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 483, pl. xxxix. fig. 4.
" " H. Rathke, Mém. Acad. Sci. St. Pétersb. iii. 1837, p. 401.
" " V. Ben. Ann. Sc. Nat. vol. xxi. 1854, p. 96.

In Coll. Brit. Mus.
Host: gills of *Acipenser sturio*.

G. 7. Lonchidium Gerst. (*Kröyeria* V. Ben.)

Head broad, with two long movable styliform processes projecting backwards. Three distinct free thoracic segments without lobes on dorsal plates. Genital segment very long, oval shape. Abdomen elongated, simple, terminating in two lanceolate setose caudal plates. Anterior antennæ 8-jointed. Posterior antennæ short, cheliform; the second maxillipeds are large and uncinate. All four pairs of thoracic limbs are biramose, each branch having three joints furnished with plumose setæ.

1) Lonchidium lineatum. ♀.

Kröyeria lineata V. Ben. Bull. Acad. Roy. Belg. 1853, t. xx. pt. i. p. 94.
" " V. Ben. Rech. sur les Crust. Belg. 1861, p. 149, pl. xxii.
" " C. Claus, Beitrag Parasit. Crust. 1858, p. 24, pl. ii.

Host: gills of *Galeus canis*.

(2) Lonchidium aculeatum. ♀.

Lonchidium aculeatum Gerst. Archiv. f. Natur. 1854, p. 189.
Host: "Shark." Atlantic.

G. 8. Clavella Oken.

Head small, rounded; thorax biarticulate, without dorsal plates or lateral processes. Genital segment very long (5 or 6 times as long as cephalothorax). Abdomen short. Caudal plates minute. Anterior antennæ 6-jointed. Posterior antennæ uncinate. Second

maxillipeds very slender. Only two pairs of thoracic limbs, both biramose and biarticulate.

(1) CLAVELLA HIPPOGLOSSI. ♀.

Clavella hippoglossi Kr. Tidsskrift, i. 1837, p. 196, pl. ii. fig. 3.
" " Guérin, Icon. du Règne Anim. 1829–43, pl. x. fig. 7.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 494.
" " V. Ben. Ann. Sc. Nat. 3 ser. vol. xvi. 1851, p. 100, pl. iii. figs. 5, 6.

In Coll. Brit. Mus.
Host: *Hippoglossus vulgaris.*

(2) CLAVELLA MULLI. ♀.

Clavella mulli V. Ben. Ann. Sc. Nat. 3 ser. vol. xvi. 1851, p. 101, pl. iii. fig. 4.
" " B.-S. Journ. M. B. Assn. Plymouth, 1896, p. 159.

Host: gills of *Mullus* sp.

(3) CLAVELLA TENUIS. ♀.

Clavella tenuis Heller, Reise d. Novara, 1865, p. 215, pl. xxiii. fig. 1.

Host: gills of *Monocentris* sp. Philippines.

G. 9. CYBICOLA B.-S. (*Helleria* B.-S.)

Head rounded. Thorax with three distinct segments bearing lateral lobes but no dorsal plates. Genital segment very long. Abdomen small, with two lanciform appendages. Anterior antennæ 6-jointed. Posterior antennæ 3-jointed, strongly hooked at the end. Second maxilliped very large, basal joint robust. Three pairs of thoracic limbs, all rudimentary, the first biramose, the second uniramose, the third stump-like.

"Male" smaller. Posterior antennæ strongly prehensile; no thoracic lateral lobes.

(1) CYBICOLA ARMATA. ♂ ♀.

Helleria armata B.-S. Ann. & Mag. N. H. ser. 7, vol. i. 1898, p. 10, pl. v. figs. 1, 2.
Cybicola " B.-S. op. cit. ii. 1898, p. 371.

In Coll. Brit. Mus.
Host: *Cybium* spp. Indian seas.

G. 10. PSEUDOCLAVELLA B.-S.

Head small, rounded. A single free thoracic segment without lobes or dorsal plates. Genital segment oval, 4 times as long as cephalothorax. Abdomen very short. Caudal plates minute, setiferous. Anterior antennæ indistinctly 3-jointed. Posterior antennæ short, uncinate. Second maxillipeds slender. Four pairs of rudimentary limbs present, the first two biramose, third and fourth from the genital segment stump-like.

(1) PSEUDOCLAVELLA OVALIS. ♀.

Pseudoclavella ovalis B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 95, pl. vi. fig. 1.

In Coll. Brit. Mus.

Host: gills of *Serranus* sp. Muscat.

G. 11. PSEUDOCYCNUS Heller.

Head oval. Thorax with three segments, bearing small lateral lobes. Genital segment long (3 times that of cephalothorax). Abdomen short, broad. Caudal appendages very small, simple. Anterior antennæ 3-jointed. Posterior antennæ small, uncinate. Second maxillipeds as moderately strong biarticulate hooks. Five pairs of rudimentary limbs; the first and third uniramose, the second biramose; fourth and fifth minute, stump-like; the last rising from the posterior extremity of the genital segment.

(1) PSEUDOCYCNUS APPENDICULATUS. ♀.

Pseudocycnus appendiculatus Heller, Reise d. Novara, 1865, p. 218, pl. xxii. fig. 7.

" " B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 368.

Hosts: gills of *Coryphæna* and *Thynnus macropterus*. Aden.

G. 12. CYCNUS M.-E. (*Congericola* V. Ben.)

Head rounded. Two distinct free thoracic segments without lobes or caudal plates. Genital segment oval. Abdomen short. Caudal plates small, setiferous. Anterior antennæ 6 jointed. Posterior antennæ 2-jointed, uncinate; second maxilliped slender. Four pairs of rudimentary thoracic limbs, all biramose.

(1) CYCNUS GRACILIS. ♀.

Cycnus gracilis M.-E. Hist. Nat. Crust. iii. 1840, p. 496, pl. xli. fig. 1.

" " Heller, Reise d. Novara, 1865, p. 216, pl. xxii. fig. 6.

Host: *Gadus*? Adriatic.

(2) CYCNUS PALLIDUS. ♀ ♂.

Congericola pallida V. Ben. Bull. Acad. Roy. Belg. t. xxi. pt. 2, 1854, p. 583.

" " V. Ben. Mém. Acad. Roy. Belg. xxxiii. 1861, p. 148, pl. xxiii.

Cycnus pallida B.-S. Journ. M. B. Assn. 1896, p. 159.

In Coll. Brit. Mus.

Host: gills of *Conger vulgaris*. European seas.

(3) CYCNUS BUDEGASSÆ.

Cycnus budegassæ Kr. Bidrag til Kundskab, 1863, p. 270, pl. xii. fig. 3.

Host: gills of *Lophius budegassa*. Mediterranean.

G. 13. NEMESIS Roux. (*Ergasilina* ?, *Pagodina*, V. Ben.)

Head oval, distinct. Thorax divided into four well-marked articulate segments. Genital portion short. Abdomen articulate, with two small caudal plates. Anterior antennæ multiarticulate. Posterior uncinate. Second maxillipeds large, with single end-claw. First pair of thoracic limbs uniramose; second, third, and fourth biramose.

(1) NEMESIS MEDITERRANEA. ♀.

Nemesis lamnæ Roux, Crust. de la Méd. pl. xx. figs. 1–9.
„ *carchariarum* Roux, op. cit. pl. xx. figs. 10–11.
„ *mediterraneum* Heller, Reise d. Novara, 1865, p. 220, pl. xxi. fig. 2.

Hosts: "Sharks." Mediterranean.

(2) NEMESIS ROBUSTA. ♀ ♂.

Ergasilina robusta V. Bened. Ann. de Sc. Nat. 3 ser. 1851, vol. xvi. p. 97, pl. iii. fig. 1.
„ „ V. Bened. Mém. Acad. Roy. Belg. 1861, p. 149, pl. xxvii.
Pagodina „ V. Bened. op. cit. 1853, vol. xx. pt. i. p. 482.

Hosts: *Trygon pastinaca, Galeus canis, Carcharias glaucus.*

G. 14. EUDACTYLINA Van Beneden.

Head obtuse, broader behind than in front. Four distinct thoracic segments without dorsal plates or lateral processes. Genital portion short. Abdomen biarticulate; caudal plates setose. Anterior antennæ with hooked basal joints. Posterior antennæ with three terminal claws. Second maxillipeds large, cheliform. First four pairs of thoracic limbs biramose; fifth uniramose.

(1) EUDACTYLINA ACUTA. ♀.

Eudactylina acuta V. Bened. Bull. Acad. Roy. Belg. vol. xx. pt. 1, 1853, p. 235.
„ „ V. Bened. Mém. Acad. Roy. Belg. 1861, p. 150, pl. xxv.

Hosts: gills of *Squatina angelus* [Rhina squatina] and *Spinax acanthias* [Acanthias vulgaris].

(2) EUDACTYLINA ASPERA. ♀.

Eudactylina aspera Heller, Reise d. Novara, 1865, p. 213, pl. xxi. fig. 1.

Host: mouth of *Carcharias pleurotænia*. Java.

G. 15. Lamproglenia Nordm.

Head distinct, quadrilateral. Thorax elongated, composed of four rings indistinctly articulated. Genital segment short. Abdomen very long; caudal plates small, lobe-like. Anterior antennæ with 10 joints. Posterior antennæ not uncinate, but provided with setæ. First maxillipeds very strongly uncinate, second terminating in 3 claws. Thoracic limbs rudimentary, the first four biramose, fifth minute, stump-like.

(1) Lamproglenia pulchella. ♀.

Lamproglenia pulchella Nordm. Mikrogr. Beiträge, 1832, Heft 2, p. 1, pl. i. fig. 1.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 487, pl. xxxix. fig. 6.
„ „ Claus, Beiträge, 1875, p. 26, pl. xxiv. fig. 33.

Host: gills of *Cyprinus jeses* [Leuciscus sp.].

(2) Lamproglenia lichiæ. ♀.

Lamproglenia lichiæ Nordm. Mikrogr. Beiträge, 1832, Heft 2, p. 134.

Host: gills of *Lichia aculeata*.

(3) Lamproglenia hemprichi. ♀.

Lamproglenia hemprichii Nordm. Mikrogr. Beiträge, 1832, Heft 2, p. 134.

Host: *Myletes dentex*.

Family IV. PHILICHTHYIDÆ. (*Lernéoapodiens* Hesse.)

Females elongated, more or less segmented, without articulated locomotive organs, but often with soft lobe-like lateral appendages. Antennæ and mouth-processes more or less rudimentary.

Males distinctly articulate, with two pairs of antennæ, two pairs of maxillipeds, the first pair of the latter being transformed into powerful hooks, and two pairs of biramose thoracic limbs, sometimes also one pair on the first abdominal segment. Small cutaneous dorsal appendages to the second thoracic segment. Abdomen generally with 8 articulations.

These parasites are all found free in the mucous canals and sinuses of various fishes.

G. 1. Philichthys Stp.

Female. The whole body distinctly multisegmented, and elongated; without dorsal plates or articulate limbs; carrying on the small rounded head as well as on the sides of the body a number of soft non-articulate appendages of very peculiar shapes and sizes.

The egg-sacs are broad and long, placed by the side of the body, and embraced by some of these processes, but not projecting. A single median eye.

Male. Much smaller, with distinctly segmented body attenuated posteriorly. Cephalothorax as a buckler, with two free thoracic rings, the second bearing two strong spines. The tail has 8 free rings, the last provided with two caudal appendages. Anterior antennæ 6-jointed. Posterior with two, the last carrying two curved setæ. First maxillipeds large.

PHILICHTHYS XIPHIÆ. ♀ ♂. (Plate XXVI. fig. 2.)

Philichthys xiphiæ Stp. Oversigt Danske Videnskab. 1861, p. 295, pl. ii.
" " Bergsoe, Monograph Fremstellet, 1864, pl. i.
" " C. Vogt, Arch. Zool. Exp. vol. vi. 1877, p. 407.

Host: mucous canals in head of *Xiphias gladius*. Europe.

G. 2. RICHIARDIA, gen. nov.

Female. Head small, obtuse. Body elongated, segmented, the second thoracic ring being very much enlarged, oval or rounded, followed by five attenuated joints, the second of which has the genital opening. Three pairs of lateral non-articulate acute processes on each side, with a pair of caudal appendages, and a pair also of frontal ones directed forwards. Anterior antennæ triarticulate. Egg-sacs long, thick, placed by the side of the body as in the preceding genus.

(1) RICHIARDIA LICHIÆ. ♀.

Philichthys lichiæ Richiardi, Atti Soc. Toscana di Sc. Nat. 1876, iii. pl. vi. fig. 1.

Host: frontal sinus of *Lichia amia*. Mediterranean.

(2) RICHIARDIA PAGRI. ♀.

Philichthys pagri Richiardi, op. cit. 1876, pl. vi. fig. 3.

Host: frontal sinus of *Pagrus vulgaris*. Mediterranean.

(3) RICHIARDIA PAGELLI. ♀.

Philichthys pagelli Richiardi, op. cit. 1876, pl. vi. fig. 4.

Host: frontal sinus of *Pagellus mormyrus*. Mediterranean.

(4) RICHIARDIA EDWARDSI. ♀.

Philichthys edwardsi Richiardi, op. cit. vol. ii. 1875, pl. vi. fig. 4.

Host: frontal sinus of *Serranus cabrilla*. Mediterranean.

(5) RICHIARDIA STEENSTRUPI. ♀.

Philichthys steenstrupii Richiardi op. cit. 1875, pl. vi. fig. 5.

Host: frontal sinus of *Mullus barbatus*, *M. surmuletus*.

(6) RICHIARDIA SCIÆNÆ. ♀ ♂.

Philichthys sciæna Richiardi, op. cit. 1875.
„ „ C. Vogt, Arch. Zool. Exp. vol. vi. 1877, p. 412.
Host: lateral line of *Sciæna umbra*. Mediterranean.

(7) RICHIARDIA DENTICIS. ♀. (Plate XXVI. fig. 3.)

Philichthys denticis Richiardi, op. cit. 1876, pl. vi. fig. 2.
Host: frontal sinus of *Dentex vulgaris*. Mediterranean.

(8) RICHIARDIA BARALDI.

Philichthys baraldii Richiardi, op. cit. vol. iii. 1876, pl. vi. fig. 5.
Host: frontal sinus of *Chrysophrys aurata*. Mediterranean.

G. 3. SPHÆRIFER Richiardi. (*Sphærosoma* Leydig.)

Female. Head small, obtuse. Body elongated, segmented; first thoracic segment slender, the second large and spherical, followed by five diminishing joints, in the second of which are seen the genital pores; there is a single pair of acute processes projecting from the enlarged segment, and a pair of elongated appendages from the last. The anterior antennæ are triarticulate. Egg-sacs globular. Male not known.

(1) SPHÆRIFER CORVINÆ.

Sphærosoma corvinæ Leydig, Arch. f. Natur. v. Trosch. xvii. 1851, p. 259.
Sphærifer cornutus Richiardi, Soc. Toscana de Sc. Nat. ii. 1876.
„ „ C. Vogt, Arch. Zool. Exp. vol. vi. 1877, p. 413.
Host: mucous canals of *Corvina nigra* and *Sciæna aquila*.

(2) SPHÆRIFER LEYDIGI. (Plate XXVI. fig. 4.)

Sphærifer leydigi Richiardi, op. cit. 1876, pl. vi. fig. 6.
Host: mucous sinus of *Umbrina cirrhosa*. Mediterranean.

G. 4. COLOBOMATUS Hesse.

Female. Head round or conical. Body elongated, segmented; three narrow free thoracic joints followed by an enlarged oval genital portion, and two or three slender abdominal joints; there are three pairs of lateral obtuse appendages, one pair of caudal, and one pair of spathulate processes from the head directed forwards. Anterior antennæ with four or five articulations. Posterior antennæ small, uncinate. Proboscis and maxillipeds present; also a small single eye. External ovarian tubes not observed. Male not known.

(1) COLOBOMATUS LAMNÆ. ♀.

Colobomatus lamnæ Hesse, Ann. Sci. Nat. ser. 5, xvii. 1873, p. 3, pl. xxiv. fig. 1.
„ „ C. Vogt, Arch. Zool. Exp. vol. vi. 1877, p. 387.
Host: nasal fossa of *Lamna cornubica*.

(2) COLOBOMATUS BERGYLTÆ. ♀. (Plate XXVI. figs. 5, 5*a*.)

Colobomatus bergyltæ Hesse, op. cit. 1873, pl. xxiv. fig. 8.
„ „ C. Vogt, op. cit. 1877, p. 411.
Host: head of *Labrus bergyltæ* [L. maculatus]. Brest.

G. 5. LEPOSPHILUS Hesse.

Female. Head small, rounded. Body elongated, segmented; thorax of two indistinct joints followed by a large dilated genital segment. Abdomen of six distinct articulations; no lateral appendages, but minute caudal setose plates. A single median eye, proboscis and small maxillipeds present.
Male very similar to that of *Philichthys*.

LEPOSPHILUS LABRI. ♀ ♂. (Plate XXVI. fig. 6.)

Lepsophilus labrii Hesse, Ann. Sci. Nat. ser. 5, vol. v. 1866, p. 265, pl. ix.
„ „ Hesse, op. cit. vol. xvii. art. 14, 1873.
„ „ C. Vogt, op. cit. 1877, p. 387.
Host: lateral sinus of *Labrus donovani*. Brest.

Family V. LERNÆIDÆ.

The body in the young, sexually mature form very similar to those of the preceding families. The anterior antennæ are short, slender, and carrying small bristles; the posterior pair are uncinate, generally projecting beyond the front border of the cephalothorax. The maxillipeds are very small and weak. There are four pairs of thoracic limbs well developed, the first two or more biramose. Genital segment of female much elongated. Abdomen rudimentary. Eye median. The larvæ vary from a cyclops-like form to those with a twisted frontal filament. In the older and fixed parasitic condition, the females are long, worm-like, generally without limbs, some with irregular excrescences from the anterior portion, others with elongated appendages from the genital segment or abdomen. Egg-sacs double.

G. 1. LERNÆOCERA Blainville.

Head not distinctly divided off, but bearing horn-like processes. Mouth terminal. Genital segment much elongated, slightly curved; the limbs placed at nearly equal distances one from another, the first four pairs biramose, triarticulate, the fifth very minute.

(1) LERNÆOCERA ESOCINA. ♀.

Lernæa cyprinacea Linn. Fauna Suecica, ii. 1761, pl. xi. fig. 2.
„ „ Blainv. Journ. de Physique, xcv. 1822, p. 337.
Lernæocera cyprinacea Burm. Nov. Act. Nat. Cur. xvii. p. 309, pl. xiv. fig. 1 (1835).
„ „ Nordm. Mikrogr. Beiträge, ii. 1832, p. 123, pl. vi. fig. 1.

Lernæocera esocina M.-E. Hist. Nat. Crust. iii. 1840, p. 527, pl. xl. figs. 13, 15.
„ *cyprinacea* M.-E. op. cit. 1840, p. 527, pl. xl. fig. 16.
„ *esocina* Herm. Naturforscher, xix. 1783, p. 44, pl. ii. fig. 6.
„ „ C. Claus, Zeitschr. gesammt. Naturwiss. xxxi. 1868, p. 530.
„ „ Richiardi, Atti Soc. Toscana di Sc. Nat. iii. 1876.
Hosts: Carp, Perch, Roach, &c.

(2) LERNÆOCERA CRUCIATA. ♀.

Lernæocera cruciata Lesueur, Journ. Ac. Philad. 1824, iii. p. 286, pl. xi. fig. 4.
„ „ M.-E. Hist. Nat. Crust. 1840, iii. p. 527.
„ „ Richiardi, Atti Soc. Toscana di Sc. Nat. iii. 1876.
Host: *Cichla cænea*, Les. Lake Erie.

(3) LERNÆOCERA PHOXINACEA. ♀.

Lernæocera phoxinacea Kllr. An. Mus. Wien.
„ „ Kr. Bidrag til Kundskab, 1863, p. 325, pl. xviii. fig. 3.
Host: *Phoxinus marsilii* [Leuciscus phoxinus].

(4) LERNÆOCERA LAGENULA. ♀.

Lernæocera lagenula Heller, Reise d. Novara, 1865, p. 246, pl. xxiv. fig. 9.
Host:—? Brazil.

(5) LERNÆOCERA POMOTIDIS. ♀.

Lernæocera pomotidis Kr. Bidrag til Kundskab, 1863, p. 323, pl. xv. fig. 5.
Host: gills of *Pomotis* sp. New Orleans.

(6) LERNÆOCERA GASTEROSTEI. ♀.

Lernæocera gasterostei, Brühl, Inst. d Univ. Pest. 200, 1860.
„ „ Heller, Reise d. Novara, 1865, p. 246.
Host: *Gasterosteus aculeatus*.

(7) LERNÆOCERA CATOSTOMI. ♀.

Lernæocera catostomi Kr. Bidrag til Kundskab, 1863, p. 321, pl. xviii. fig. 4.
Host: *Catostomus macrolepidotus*, Les. Mississippi.

G. 2. THERODAMUS Kröyer.

Head rounded, without horn-like appendages; mouth opening at the base of the long slender neck. Thorax much elongated, indis-

tinctly segmented. Genital ring short. Abdomen small, with two minute caudal plates. Posterior antennæ strongly uncinate. All four pairs of thoracic limbs present, biramose and triarticulate.

(1) THERODAMUS SERRANI. ♀.

Therodamus serrani Kr. Bidrag til Kundskab, 1863, p. 316, pl. xv. fig. 4.

Host: gills of *Serranus* sp. West Indies.

G. 3. PENICULUS Nordm.

Head oval, without horn-like processes. Thorax distinctly segmented, giving rise to four pairs of limbs, the first two pairs being placed close behind the head, the third and fourth some distance removed from them and from each other. Genital segment very long. Abdomen small, with minute caudal plates.

Male smaller than female, with a short genital segment.

(1) PENICULUS FISTULA. ♀ ♂.

Peniculus fistula Nordm. Mikrog. Beiträge, 1832, p. 107, pl. vi. fig. 8.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 497.
" " Heller, Reise d. Novara, 1865, p. 248, pl. xxv. fig. 3.
" " Claus, Rech. über *Lernæocera* &c. 1868, p. 12, pls. ii., iii

Host: *Zeus faber*.

(2) PENICULUS FURCATUS. ♀.

Peniculus furcatus Kr. Bidrag til Kundskab, 1863, p. 268, pl. xii. fig. 4.
" " Claus, op. cit. 1868, p. 12.

Host: gills of *Holacanthus* [Tetrodon] sp. East Indies.

(3) PENICULUS CLAVATUS. ♀.

Peniculus clavatus Kr. Bidrag til Kundskab, 1863, p. 266, pl. xiv. fig. 8.

Lernæa clavata Müll.

Host: fins of *Sebastes norvegicus*. Greenland.

G. 4. PENELLA Oken. (*Lernæopinna* Blainv.)

Head large, globose, tuberculate, with arm-like projections directed backwards; the neck is long and straight, not distinctly segmented, united with the elongated genital segment in the same line. Abdomen penniform. Four pairs of limbs are present, placed close behind the head and together; the first two are biramose, the third and fourth uniramose, each branch with two joints.

Male minute, not elongated.

Young form of female as "*Hessella cylindrica*" Brady, Chall. Rep. vol. xxiii. p. 190, pl. xxix. figs. 40–42, and *Baculus elongatus*,

Lubbock, Trans. Linn. Soc. Lond. 1860, vide Bidrag Anat. der Lernæiden, Al. Mrázek, 1895.

(1) PENELLA SAGITTA. ♀.

Pennatula sagitta Linn. Amœn. Acad. iv. 1754, p. 257, pl. iii. fig. 13.
Lernæopinna sagitta Gmel. Syst. Nat. 1788, p. 3865.
„ „ Blainv. Journ. de Physique, xcv. p. 479.
Penella sagitta Nordm. Mikrogr. Beiträge, 1832, p. 121, pl. x. fig. 6.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 522.
„ „ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 409, pl. xiv. fig. 31.
In Coll. Brit. Mus.
Hosts: *Lophius* [Antennarius] *tumidus*; *L. marmoratus*; *Chironectes*.

(2) PENELLA FILOSA. ♀.

Pennatula filosa Linn., Syst. Nat. et Amœn. Acad. iv. 1754.
„ „ Guérin, Icon. Zooph. pl. ix. fig. 3.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 523.
Host: *Orthagoriscus mola*. Atlantic.

(3) PENELLA EXOCŒTI. ♀ ♂.

Lernæa exocœti Holten, Naturhist. Skrifter, 136, 1802, pl. iii. fig. 3.
Lernæopenna holteni Blainv. Journ. de Physique, 1822.
„ *blainvillii*, Lesueur, Journ. Ac. Nat. Sc. Philad. iii. 1823, p. 291, pl xi. fig. 2
Penella exocœti Stp. & Lütk. Bidrag til Kundskab, 1861, p. 415, pl. xiv. fig. 33.
In Coll. Mus. Brit.
Host: *Exocœtus volitans* [E. evolans]. Indian Ocean.

(4) PENELLA VARIANS. ♀ ♂.

Penella varians Stp. & Lütk. Bidrag til Kundskab, 1861, p. 413, pl. xiv. fig. 32.
„ *pustulosa*? Baird, Ann. Nat. Hist. xix. p. 280.
Host: fin of *Coryphæna* sp. Atlantic.

(5) PENELLA DIODONTIS. ♀.

Penella diodontis Oken, Chamisso & Esenhart, Nov. Act. Acad. Cæs. Leop. Bonn, x. 1821.
„ *brachiata* Blainv. Journ. de Physique, 1822.
„ „ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 412.
Host: *Diodon sexmaculatus*. Manila.

(6) PENELLA HISTIOPHORI. ♀.

Penella histiophori Thomson, Trans. N. Z. Inst. vol. xxii. 1889, p. 368, pl. xxviii. fig. 2.
Host: *Histiophorus herscheli*. New Zealand.

G. 5. LERNÆENICUS Les. (*Lernæonema* M.-E.)

Head rounded or obliquely pointed, with short, simple, horn-like excrescences projecting backwards; neck non-segmented, long, passing gradually into the genital segment, which is in the same straight line. Abdomen without penniform processes. Thoracic limbs placed close together just behind the head, the two first biramose, the third and fourth uniramose, all with two joints.

(1) LERNÆENICUS SPRATTÆ. ♀.

Lernæa spratta Sowerby, Brit. Miscell. ii. 1806, p. 17, pl. lxviii.
„ *cyclophora* Blainv. Journ. de Physique, xcv. 1822, p. 436.
Lernæocera surrirensis Blainv. Dict. Hist. Nat. xxvi. 1823, p. 117.
Lernæa ocularis Cuv. Règne Animal, ii. vol. iii. 1830, p. 256.
Froculum spratti Thompson, Cat. Mus. Coll. Surg.
Lernæonema monilaris M.-E. Hist. Nat. Crust. iii. 1840, p. 525, pl. xli fig. 5.
„ *spratta* Baird, Brit. Entom. 1850, p. 341, pl. xxxv. fig. 10.
„ *bairdi* Salter, Ann. & Mag. N. H. (2) vi. 1850, p. 86, pl. vii. fig. 1.
„ *monilaris* Heller, Reise d. Novara, 1865, p. 248, pl. xxv. fig. 4.
Lernæenicus spratta Olsson, Prod. Faun. Copep. 1869, p. 46.
„ „ Richiardi, Descr. di Lernæen., Atti Soc. Toscana Sci. Nat. vol. iii.

In Coll. Brit. Mus.

Host: *Clupea spratta*. Europe.

(2) LERNÆENICUS ENCRASICOLI. ♀.

Lernæa encrasicoli Turton, Brit. Fauna, i. 1807, n. 108.
Lernæonema encrasicoli Baird, Brit. Entom. 1850, p. 341, pl. xxxv. fig. 11.
Lernæenicus encrasicoli Olsson, Prod. Faun. Copep. 1869, p. 46.
„ „ Richiardi, Atti della Soc. Toscana di Sci. Nat. vol. iii.

In Coll. Brit. Mus.

Hosts: *Engraulis encrasicolus* and *Clupea spratta*.

(3) LERNÆENICUS ABDOMINALIS. ♀.

Lernæonema abdominalis M.-E. Hist. Nat. Crust. 1840, p. 525.
„ „ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 398.
Lernæenicus abdominalis Richiardi, Atti della Soc. Toscana, vol. iii.

Host:—? Valparaiso.

(4) LERNÆENICUS RADIATUS. ♀.

Lernæocera radiata Lesueur, Journ. Ac. Nat. Sc. Philad. iii. 1824, p. 288, pl xi. fig. 1.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 528.

Lernæenicus radiatus Stp. & Lütk. Bidrag til Kundskab, 1861, p. 400.
„ „ Richiardi, Atti della Soc. Toscana Sci. Nat. vol. iii. p. 8.
Hosts: *Clupea tyrannus* and *C. mattowacca*.

(5) LERNÆENICUS NODICORNIS. ♀.

Lernæenicus nodicornis Stp. & Lütk. Bidrag til Kundskab, 1861, p. 401, pl. xiii. fig. 26.
„ „ Richiardi, op. cit. p. 8.
Host: *Coryphæna* sp.

(6) LERNÆENICUS INFLEXUS. ♀.

Lernæenicus inflexus Stp. & Lütk. op. cit. 1861, p. 401, pl. xiii. fig. 27.
„ „ Richiardi, op. cit. vol. iii. p. 8.
Host: gills of "Barracotta." Atlantic.

(7) LERNÆENICUS GRACILIS. ♀.

Lernæonema gracilis Heller, Reise der Novara, 1865, p. 249, pl. xxv. fig. 5.
Lernæenicus gracilis Richiardi, op. cit. vol. iii. p. 8.
Host: body of *Lichia amia*.

(8) LERNÆENICUS POLYNEMI. ♀.

Lernæenema polynemi B.-S. Ann. & Mag. N. H. ser. 7, vol. i. 1898, p. 12, pl. vii. fig. 1.
In Coll. Brit. Mus.
Host: body of *Polynemus tetradactylus*. Bombay.

(9) LERNÆENICUS VORAX. ♀.

Lernæenicus vorax Richiardi, op. cit. p. 9, pl. vii. figs. 1–21.
Hosts: *Sciæna aquila*, *Corvina nigra*, *Labrax lupus*, &c.

(10) LERNÆENICUS NEGLECTUS. ♀.

Lernæenicus neglectus Richiardi, op. cit. p. 13, pl. vii. figs. 22-43.
Hosts: *Mugil cephalus*, *M. capito*, *M. chelo*, *M. auratus*.

(11) LERNÆENICUS MUSTELI. ♀ ♂.

Lernæonema musteli V. Ben. Bull. de l'Acad. Belg. 1861, p. 154, pl. xxix.
„ „ V. Ben. Ann. Sc. Nat. xvi. 1851, p. 125.
In Coll. Brit. Mus.
Host: gills of *Mustelus vulgaris*.

G. 6. ECHETUS Kr.

Head obtuse, separated by a long thin neck from the short

squarish genital segment. Abdomen as a long pedunculated sac, terminating in two minute caudal appendages. Egg-tubes filiform; ovules uniseriate. The minute articulate appendages have not been described.

(1) ECHETUS TYPICUS. ♀.

Echetus typicus Kr. Bidrag til Kundskab, 1863, p. 315, pl. xv. fig. 6.

Host: *Corvina unimaculata*. New Orleans.

G. 7. LOPHURA Kollar.

Head oval, in the same straight line as the neck and genital segment, having two wing-like processes at its base; neck slender. Genital segment squarish, giving off posteriorly two bundles of filiform appendages.

(1) LOPHURA EDWARDSI. ♀.

Lophura edwardsi C. Claus, Nat. Zeitschrift, 1860, pl. x. fig. 11.

Host:—? Mediterranean.

G. 8. LERNÆOLOPHUS Heller.

Head globular, carrying three strong branching horns; neck long, chitinous, curved. Genital segment S-shaped, bearing over the posterior or abdominal portion extremely numerous, long, tassel-like appendages. Four pairs of limbs placed close behind the head and near together. Egg-sacs long; ovules uniseriate.

(1) LERNÆOLOPHUS SULTANUS. ♀.

Lernæolophus sultanus Heller, Reise d. Novara, 1865, p. 251, pl. xxv. fig. 7.

Penella sultana M.-E. Hist. Nat. Crust. iii. 1840, p. 523.

In Coll. Brit. Mus.

Hosts: *Serranus scriba*, *S. cabrilla*, Mediterranean; also *Caranx* sp.

(2) LERNÆOLOPHUS HEMIRHAMPHUS. ♀.

Lernæa hemirhamphi Kr. Bidrag til Kundskab, 1863, p. 318, pl. xv. fig. 7.

Host: *Hemirhamphus* sp. West Indies.

G. 9. LERNÆA Linn.

Head globular, with strong branching horns; neck cylindrical, chitinous. Genital segment strongly bent in S-shape, simple. Egg-tubes long, convoluted. Four pairs of thoracic limbs placed close behind the head, the first two biramose, third and fourth uniramose; all with plumose setæ.

(1) LERNÆA BRANCHIALIS. ♀ ♂.

Lernæa branchialis Linn. Syst. Nat. 12 ed. 1767, p. 1092; Lamarck, Cuvier, Burmeister, Guérin, Kröyer, Oken, M.-E., Thompson, Baird, Stp. & Lütk., V. Ben., B.-S., Hesse.

„ „ ♂ Claus, Beitrag zur Naturges. der Lern. 1868, p. 16, pl. iii., iv.

„ „ Al. Mrázek, Beitrag zur Anat. der Lern. 1895.

„ „ I. C. Thompson, Rep. Copep. of Liverp. Bay, 1893, pl. xxiv.

„ *gadina* Müll. Zool. Dan. iv. p. 65, pl. cxviii. fig. 4.

„ „ O. Fabr. Faun. Grœnl. 1780, p. 339.

Lernæocera branchialis Blainv. Journ. de Physique, xcv. 1823, p. 376, pl. xxvi. fig. 1.

„ „ Nordm. Mikrogr. Beiträge, ii. 1832, p. 130.

„ *sigmoidea* Stp. & Lütk. Bidrag til Kundskab, 1861, p. 404, pl. xiii. fig. 29.

In Coll. Brit. Mus.

Host: gills of *Gadidæ*. N. temperate region.

(2) LERNÆA RIGIDA. ♀.

Lernæa rigida Kr. Bidrag til Kundskab, 1863, p. 320, pl. xviii. fig. 2.

Host:— ? Valparaiso.

(3) LERNÆA LUSCI. ♀.

Lernæa lusci B.-S. Ann. & Mag. N. H. ser. 6, xviii. 1896, p. 13, pl. iv. fig. 6.

In Coll. Brit. Mus.

Host: gills of *Gadus luscus*. Plymouth.

(4) LERNÆA LOTELLÆ. ♀.

Lernæa lotellæ Thomson, Trans. N. Z. Inst. 1889, vol. xxii. p. 369, pl. xxviii. fig. 3.

In Coll. Brit. Mus.

Host: *Lotella bacchus*. N. Zealand.

G. 10. HÆMOBAPHES Stp. & Lütk.

Head rectangular, without horn-like processes. Two more or less distinct thoracic segments are visible crowded behind the head, each with a pair of bilobed, not articulated limbs; neck very elongated, acutely curved, near which flexure are two short blunt processes. Genital segment dilated, twisted on itself, with, on either side over the origin of the spirally coiled egg-tubes, a pair of tubercles; abdominal portion considerably narrower, with blunted extremity. Two pairs of biramose biarticulated limbs are present.

(1) Hæmobaphes cyclopterinus. ♀.

Lernæa cyclopterina Fabr. Fauna Grœnl. 1780, p. 337.
Lernæocera cyclopterina Blainv. Journ. de Physique, xcv. 1823, p. 376.
Lernæa cyclopterina Kr. Tidsskrift, i. 1837, p. 502, pl. v. fig. 4.
Lernæa cyclopterina M.-E. Hist. Nat. Crust. iii. 1840, p. 529.
Hæmobaphes cyclopterina Stp. & Lütk. Bidrag til Kundskab, 1861, p. 405, pl. xiii. fig. 30.

Hosts: *Cyclopterus spinosus*, *Cottus* spp., *Gadus* sp., *Gunnellus* [Centronotus] *fasciatus*, *Sebastes norvegicus*. Faroe Is. &c.

G. 11. Peroderma Heller.

Head globular, covered with numbers of closely placed fine-branching processes, united to the long sac-like genital segment by a short, narrow, slender neck, at a right angle and one-third from the extremity. Anterior antennæ triarticulate, setiferous. First two pairs of true limbs biramose, others uniramose, each with two joints. Egg-sacs long; ovules in a single row.

(1) Peroderma cylindricum. ♀.

Peroderma cylindrica Heller, Reise d. Novara, 1865, p. 250, pl. xxv. fig. 6.
„ „ Richiardi, Atti della Soc. Toscana, 1875, vol. ii. pl. iv. fig. 1.
„ *branchiata* B.-S. Ann. & Mag. N. H. ser. 7, vol. i. 1898, p. 13, pl. vii. fig. 2.

Hosts: 'Sardine' in Mediterranean; *Coilia dussumieri*, Bombay.

Family VI. CHONDRACANTHIDÆ.

Female forms incompletely or indistinctly segmented, often of particularly bizarre appearance from the growth of irregular lobes and prolongations. The anterior antennæ are short, 2–3-jointed, the posterior generally in the form of simple hooks, often powerful. Maxillipeds small, unciform, close to the mouth-opening; limbs generally in the form of non-articulate lobes. Sex-organs paired, often very voluminous. External ovaries claviform; ovules multiseriate in most cases, sometimes convoluted or hidden.

The pigmy male is out of all proportion to the female, to which it is firmly adherent. It has a distinct cephalothorax, segmented abdomen, and is furnished with articulate limbs.

G. 1. Sphyrion Cuv. (*Lesteira* Kr.)

Head float-like, enlarged transversely, separated by a long cylindrical neck from the genital segment, which is cordiform or oval, flattened antero- posteriorly; this gives off on either side of the rudimentary abdomen a bunch of hard grape-like processes projecting backwards. Thoracic limbs suppressed. Egg-tubes long, robust. Antennæ as non-articulate lobes.

(1) SPHYRION LÆVIGATUM. ♀.

Sphyrion lævigatus Cuv. Règne Anim., Zooph. 1830, pl. xxxii. fig. 4.
Chondracanthus levis Quoy & Gai., Freycinet Reise Zool. 1824, p. 541, pl. lxxxvi. fig. 10.
„ „ Guérin, Iconogr. Zooph. pl. ix. fig. 4.
„ „ Stp. Overs. Vidensk. Selsk. Kjöbenh. 1869, p. 187.
Lesteira kröyeri Thomson, Trans. N.Z. Inst. vol. xxii. 1889, p. 370, pl. xxviii. fig. 4.

In Coll. Brit. Mus.

Hosts: *Gadus* sp., Cape of Good Hope (Q. & G.); *Genypterus blacodes*, N.Z. (Thoms.).

(2) SPHYRION LUMPI. ♀.

Lestes lumpi Kr. Danmk. Fiske, ii. 1845, p. 217.
Lesteira lumpi Kr. Bidrag til Kundskab, 1863, p. 325, pl. xviii. fig. 5.
„ „ Stp. Overs. Vidensk. Selsk. Kjöbenh. 1869, p. 182, pl. ii. fig. 5.

In Coll. Brit. Mus.

Host: *Cyclopterus lumpus*. Denmark; ? Dungeness.

G. 2. MEDESICASTE Kröyer.

Head minute, rounded, with both pairs of antennæ, and two pairs of minute uncinate maxillipeds and mouth in front. Thoracic portion very elongated, divided into two parts, the anterior being the broader, having at its base two wing-like processes, the posterior portion cylindrical. Genital segment as broad as long, robust, deeply emarginate in front and behind. Abdomen small, biarticulate. Egg-sacs long, club-shaped. One pair (?) of bilobed thoracic limbs placed close behind the head.

Male pigmy, like those of *Chondracanthus*.

1. MEDESICASTE TRIGLARUM. ♀.

Medesicaste triglarum Kr. Bidrag til Kundskab, 1863, p. 312, pl. xviii. fig. 1.

Host: *Trigla hirundo*. Kattegat.

2. MEDESICASTE PENETRANS. ♀.

Medesicaste penetrans Heller, Reise d. Novara, 1865, p. 235, pl. xxv. fig. 1.

Host: *Trigla capensis*. Cape of Good Hope.

G. 3. ORALIEN, gen. nov.

Head rounded in front, carrying there the two pairs of antennæ, and lateral lobe-like projections; produced posteriorly as a cylindrical neck more or less long, at the juncture of which with

the thoracic segment are distinctly seen the mouth, maxillæ, and two pairs of maxillipeds. Body large, convex above, concave beneath, robust, with margins deeply incised; it is divided into two portions, the thoracic bearing on the ventral side two pairs of blunt lobed processes, and the genital rounded and larger. Abdomen biarticulate. Egg-sacs elongated, claviform.

Male pigmy as in *Chondracanthus*.

Oralien asellinus. ♂ ♀. (Plate XXVI. figs. 1, & 1*a*–1*c*.)

Lernæa asellina Linn. Fauna Suec. 1761, p. 510.
Lernæntoma triglæ Blainv. Jour. de Physique, xcv. 1822, p. 441, pl. lxii. fig. 12.
" " Blainv. Dict. des Sc. Nat. xxiv. 1823, p. 125.
Chondracanthus triglæ Nordm. Mikrogr. Beiträge, ii. 1832, p. 116, pl. ix. fig. 1.
" " Guérin, Iconograph. pl. ix. fig. 8.
" " Kröyer, Tidsskrift, ii. 1838, p. 135, pl. iii. fig. 33.
" " V. Ben. Ann. Sc. Nat. 3 ser. xvi. 1851, p. 109.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 502.
" " Stp. Bull. Soc. Roy. Dan. 1869, pl. ii. fig. 1.
" " B.-S. Ann. & Mag. N. H. ser. vi. 1896, p. 13, pl. iv. fig. 4.
Lernentoma asellina Baird, Brit. Entom. 1850, p. 329, pl. xxxv. fig. 4.
Chondracanthus gurnardi Kr.
" " Stp. Bull. Soc. Roy. Dan. 1869, pl. ii. fig. 3.

In Coll. Brit. Mus.

Hosts: gills of *Gadus* sp. and *Trigla* spp. Europe.

G. 4. Strabax Nordm.

Head oblong, with six knob-like swellings. Body elongated, widening posteriorly, where it gives off on either side four filiform processes. Abdomen pyriform, $\frac{1}{3}$ as long as processes; limbs suppressed.

Male pigmy, distinctly segmented, and provided with limbs.

(1) Strabax monstrosus. ♂ ♀.

Strabax monstrosus Nordm. Bull. Soc. Imp. N. H. Moscou, 1864, t. xxxvii., pl. v. fig. 10.

Host: *Scorpæna porcus*. Mediterranean.

G. 5. Trichthacerus Kröyer.

Head short, dilated, separated from the oval non-segmented body by a constriction. Abdomen small, articulate. Anterior

antennæ slender, with three joints. Posterior large, trifurcate. There are four pairs of rudimentary limbs, the first biramose. Ovarian sacs long; ovules multiserial.

Male pigmy, like those of *Chondracanthus*.

(1) TRICHTHACERUS PERISTEDII. ♀ ♂.

Trichthacerus peristedii Kr. Bidrag til Kundskab, 1863, p. 264. pl. xiv. fig. 7.

Host: gills of *Peristethus* sp. Rio Janeiro.

(2) TRICHTHACERUS MOLESTUS. ♀.

Trichthacerus molestus Heller, Reise d. Novara, 1865, p. 233, pl. xxiii. fig. 5.

Host: gills of *Prionotus punctatus*. Brazil.

G. 6. BLIAS Kröyer.

Head rounded, separated by a constriction from the smooth, thick, oval body, which is unsegmented and without processes. Abdomen biarticulate, small, with two short terminal setæ. Anterior antennæ short, thick. Posterior are two-jointed, uncinate. Mouth at the posterior part of the head. Two pairs of single branched articulate limbs are present.

Male pigmy, like those of *Chondracanthus*.

BLIAS PRIONOTI. ♀ ♂.

Aethon prionoti Kllr. Ann. Wien. Mus.

Blias prionoti Kr. Bidrag til Kundskab, 1863, p. 262, pl. xii. fig. 5.

Host: gills of *Prionotus punctatus*. Brazil.

G. 7. CHONDRACANTHUS. De la Roche. (*Lernentoma* Blainv.)

Head distinct, separated from the body by a more or less constricted neck. Thorax indistinctly biarticulate, bearing two pairs of lobe-like limbs. Genital segment compressed with concave borders, or provided with irregular globose or elongated processess. Abdomen distinctly articulated, placed between the two posterior horns. Anterior antennæ 2- or 3-jointed. Posterior uncinate, strong. Mouth and appendages placed a little behind these. External ovaries large; ovules multiseriate.

Male pigmy; the cephalothorax carries the strong hook-like posterior antennæ (or hooks of attachment) on the dorsal surface; abdomen segmented; thoracic limbs articulate.

(1) CHONDRACANTHUS CORNUTUS. ♂ ♀.

Lernæa cornuta Müll. Zool. Dan. i. 1776, pl. xxxiii. fig. 6.

Entomoda cornuta Lamarck, Hist. Anim. sans Vert. viii. 1818.

Anops cornuta Oken, Lehrbuch Naturg. iii. 1815.

Lernentoma cornuta Blainv. Dict. Sc. Nat. xxvi. 1823, p. 126.

Chondracanthus cornutus Cuv. Règne Anim. iii. 1830, p. 258.
" " Nordm. Mikrogr. Beiträge, ii. 1832, p. 111, pl. ix. fig. 10.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 500, pl. xl. fig. 18.
Lernentoma cornuta Baird, Brit. Entom. 1850, p. 328, pl. xxxv. fig. 2.
Chondracanthus cornutus Kr. Bidrag til Kundskab, 1863, p. 249, pl. xiii. fig. 7.
" " V. Ben. Ann. des Sc. Nat. 3 ser. xvi. 1851, p. 108, pl. iv. fig. 1.
&c.
" *furæ* Kr., Var., Bidrag til Kundskab, 1863, p. 249, pl. xiii. fig. 6.
" *solecæ* Kr., Var., Tidsskrift, i. 1837, p. 139, pl. iii.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 501.
" " V. Ben. Ann. Sc. Nat. xvi. 1851, p. 109.

In Coll. Brit. Mus.

Host: gills of various *Pleuronectidæ*.

(2) CHONDRACANTHUS OPHIDII. ♀.

Chondracanthus ophidii Kr. Bidrag til Kundskab, 1863, p. 244, pl. xii. fig. 6.

Host: gills of *Ophidium* (*blacodes*?). Valparaiso.

(3) CHONDRACANTHUS MACRURUS. ♀.

Chondracanthus macrurus Brady, Challenger Rep. viii. 1883, p. 137, pl. lv. fig. 4.

Host: *Macrurus* sp. Kermadec Is.

(4) CHONDRACANTHUS CLAVATUS. ♀ ♂.

Chondracanthus clavatus B.-S. Ann. & Mag. N. H. ser. 6, xviii. 1896, p. 13, pl. v. fig. 6.

In Coll. Brit. Mus.

Host: gills of *Pleuronectes microcephalus*. Plymouth.

(5) CHONDRACANTHUS SICYASIS. ♀ ♂.

Chondracanthus sicyasis Kr. Bidrag til Kundskab, 1863, p. 244, pl. xiii. fig. 4.

Host: gills of *Sicyases* sp. Valparaiso.

(6) CHONDRACANTHUS LIMANDÆ. ♀ ♂.

Chondracanthus limandæ Kr. Bidrag til Kundskab, 1863, p. 248, pl. xiv. fig. 2.

Host: gills of *Platessa* [Pleuronectes] *limanda* Linn.

(7) CHONDRACANTHUS PSETTI. ♀.

Chondracanthus psetti Kr. Bidrag til Kundskab, 1863, p. 243, pl. xiii. fig. 5.

Host: *Pleuronectes* sp. Valparaiso.

(8) CHONDRACANTHUS LOTELLÆ. ♀.

Chondracanthus lotellæ Thomson, Trans. N.Z. Inst. vol. xxii. 1889, p. 372, pl. xxviii. fig. 7.

In Coll. Brit. Mus.

Host: gills of *Lotella bacchus*. New Zealand.

(9) CHONDRACANTHUS CRASSICORNIS. ♀.

Chondracanthus crassicornis Kr. Tidsskrift, i. 1837, p. 203, pl. ii. fig. 10.

„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 501.

Host: *Labrus*.

(10) CHONDRACANTHUS BREVICOLLIS. ♀.

Chondracanthus brevicollis Kllr. Ann. Wien. Mus.

„ „ Kr. Bidrag til Kundskab, 1863, p. 246, pl. xiii. fig. 3.

Host: —? Indian Ocean.

(11) CHONDRACANTHUS ANGUSTATUS. ♀.

Chondracanthus angustatus Heller, Reise d. Novara, 1865, p. 230, pl. xxiii. fig. 2 (not 3).

„ „ Schaub, Arbeit. Akad. Wien, 1876, pls. i.–iii.

Host: *Uranoscopus scaber*. Mediterranean.

(12) CHONDRACANTHUS ALATUS. ♀ ♂.

Chondracanthus alatus Heller, Reise d. Novara, 1865, p. 231, pl. xxiii. fig. 3 (not 2).

„ „ B.-S. Ann. & Mag. N. H. ser. 7, i. 1898, p. 14.

Hosts: *Hippoglossus walako*, Singapore; *Psettodes erumei*, Bombay.

(13) CHONDRACANTHUS ELONGATUS. ♀ ♂.

Chondracanthus elongatus B.-S. Ann. & Mag. N. H. ser. 7, vol. i. 1898, p. 14, pl. vi. fig. 4.

In Coll. Brit. Mus.

Host: *Solea* sp. Bombay.

(14) CHONDRACANTHUS HORRIDUS. ♀.

Chondracanthus horridus Heller, Reise d. Novara, 1865, p. 232, pl. xxiii. fig. 4.

Host: *Gobius jozo*. Mediterranean.

(15) CHONDRACANTHUS CHYLOMYCTERI. ♀.

Chondracanthus chylomycteri Thoms. Trans. N.Z. Inst. xxii. 1889, p. 371, pl. xxviii. fig. 5.

Host: mouth of *Chylomycterus jaculiferus*. New Zealand.

(16) CHONDRACANTHUS GENYPTERI. ♀.

Chondracanthus genypteri Thoms. Trans. N.Z. Inst. xxii. 1889, p. 372, pl. xxviii. fig. 6.

Host: *Genypterus blacodes*. New Zealand.

(17) CHONDRACANTHUS RADIATUS. ♀.

Chondracanthus radiatus Müll. Zool. Danica, i. 1776, pl. xxxviii. fig. 3.

Lernentoma radiata Blainv. Dict. Sci. Nat. xxvi. 1823, p. 124.

Entomoda radiata Lamarck, Hist. des Anim. s. Vert. iii. p. 223.

Chondracanthus radiatus Kr. Bidrag til Kundskab, 1863, p. 251, pl. xiv. fig. 1.

Hosts: *Coryphœna* (*Macrurus*) *rupestris*. Greenland.

(18) CHONDRACANTHUS MERLUCCII. ♀ ♂.

Chondracanthus merluccii Holt, Mem. Soc. Hist. Nat. Copenhag. vol. v. pl. iii. fig. 2.

„ „ Kr. Tidsskrift, i. 1837, p. 278, pl. iii. fig. 9.

„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 503.

„ „ B.-S. Journ. M. B. Assn. Plymouth, 1896, p. 161.

„ *xyphiæ*? Cuv. Iconogr. Zool. pl. ix. fig. 20.

In Coll. Brit. Mus.

Host: gills of *Merluccius vulgaris*.

(19) CHONDRACANTHUS NODOSUS. ♀.

Lernæa nodosa Müll. Zool. Danica, 1776, p. 40, pl. xxxiii. fig. 5.

„ „ Lamarck, Hist. des Anim. s. Vert. iii. 1818, p. 231.

Lernentoma nodosa Blainv. Dict. Sci. Nat. xxvi. 1823, p. 125.

Chondracanthus nodosus Kr. Tidsskrift, ii. 1838, p. 133, pl. iii. fig. 2.

„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 503.

Host: *Pleuronectes* sp.

(20) CHONDRACANTHUS LOPHII. ♀ ♂.

Chondracanthus lophii Johnst. Loud. Mag. N. H. 1836, p. 181, fig. 16.

„ „ Rathke, Nov. Act. Nat. Cur. 1843, xx. p. 116, pl. v. fig. 2.

„ *gibbosus* Thomps. Ann. Mag. N. H.

„ „ Kr. Tidsskrift, 1840, p. 738, pl. ii. fig. 4.

„ „ V. Ben. Ann. d. Sc. Nat. xvi. 1851, pl. iii. fig. 10.

Lernentoma lophii Baird, Brit. Entom. 1850, p. 330, pl. xxxv. fig. 3.
Chondracanthus lophii B.-S. Journ. M. B. Assn. Plymouth, 1896. p. 162.
In Coll. Brit. Mus.
Host: gills of *Lophius piscatorius*.

(21) CHONDRACANTHUS ZEUS. ♀ ♂.

Chondracanthus zei De la Roche, Nouv. Bull. de Soc. Philom. ii. 1811, p. 270, pl. ii. fig. 2.
„ *delarochiana* Blainv. Journ. Physique, xcv. 1822, pl. xxvi. fig. 13.
„ *zei* Burmeister, Nov. Act. Nat. Cur. xvii. 1831, p. 325.
„ „ Guérin, Iconogr. Zool. pl. ix. fig. 9.
„ *tuberculatus* Nordm. Mikrogr. Beiträge, 1832, p. 118.
„ *zei* M.-E. Hist. Nat. Crust. 1840, p. 504.
Lernentoma zei Baird, Brit. Entom. 1850, p. 327, pl. xxxv. fig. 1.
Chondracanthus zei V. Bened. Ann. Sc. Nat. xvi. 1851, p. 110, pl. iv. fig. 5.
„ „ B.-S. Journ. M. B. Assn. Plymouth, 1896, p. 162.
In Coll. Brit. Mus.
Host: gills of *Zeus faber*.

G. 8. DIOCUS Kröyer.

Head small, with long pointed processes on either side directed outwards. Body short, compressed, squarish, deformed, with obtuse nodular arm-like projections. Egg-sacs convoluted. Anterior antennæ 3- or 4-jointed. Posterior small, uncinate.

(1) DIOCUS GOBINUS. ♀.

Lernæa gobina Fabr. Zool. Dan. 2747.
„ „ Müll. Fauna Grœnlandica, 389.
Chondracanthus gobinus Kr. Tidsskrift, 1837, p. 289.
Diocus gobinus Kr. Bidrag til Kundskab, 1863, p. 259.
„ „ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 423, pl. xv. fig. 39.
Host: *Cottus gobio*. North Sea.

G. 9. TANYPLEURUS Stp. & Lütk. (*Ismalia* Berg.)

Head small, rounded, covered with a number of papilliform processes. Body in the form of two wide incurving lobes, much shorter than deep, with irregularly cut borders. Abdomen short. Limbs not apparent. Egg-sacs twisted, partially hidden.
Male not known.

(1) TANYPLEURUS ALCICORNIS. ♀.

Tanypleurus alcicornis Stp. & Lütk. Bidrag til Kundskab, 1861, p. 425, pl. xv. fig. 30.

Hosts: *Cyclopterus spinosus*, *Scymnus microcephalus* [Læmargus borealis]. Greenland.

Family VII. LERNÆOPODIDÆ.

Adult female with the body robust, incompletely or not at all segmented. The anterior antennæ are small, springing from the inside of the posterior ones, which are generally two-branched. Mouth conical, with a ciliated margin in which is seen the dentate slender mandible. Maxillæ curved, toothed, and free. First maxillipeds large, as strong hook-like limbs. Second maxillipeds converted into organs of attachment, sometimes long and slender, others united throughout, or short and dilated, terminating in a fixing apparatus. Thoracic limbs often totally suppressed. External ovaries as dilated sacs. Generally a fixed parasite.

Male pigmy, found on some portion of the female (head, arms, or body). It is strikingly different and proportionately very small. Articulate limbs more or less represented, but varying considerably in different genera, and useful as a means of classification.

G. 1. THYSANOTE Kröyer.

Cephalothorax not markedly attenuated, joining imperceptibly with the body, which is dilated and flattened; the second maxillipeds, like the hinder part of the body, giving rise to fimbriform appendages. Abdomen minute. Anterior antennæ slender, articulate; posterior uniform. Second maxillipeds united at the end.

Male with distinct cephalothorax, and elongated segmented abdomen.

(1) THYSANOTE POMACANTHI. ♀.

Thysanote pomacanthi Kr. Bidrag til Kundskab, 1863, p. 288, pl. xv. fig. 1.

Host: gills of *Pomacanthus paru*. West Indies.

(2) THYSANOTE FIMBRIATA. ♀.

Brachiella fimbriata Heller, Reise d. Novara, 1865, p. 240, pl. xxiv. fig. 2.

Host: gills of *Serranus sexfasciatus*. Batavia.

(3) THYSANOTE LOBIVENTRIS. ♀.

Brachiella lobiventris Heller, Reise d. Novara, 1865, p. 241. pl. xxxiv. fig. 3.

Host: gills of *Rhypticus saponaceus*. Brazil.

(4) Thysanote appendiculata. ♀ ♂.

Brachiella appendiculata Stp. & Lütk. Bidrag til Kundskab, 1861, p. 419, pl. xv. fig. 35.
„ „ Carl Vogt, Arch. Zool. Exp. xvi. 1877.
„ *appendiculosa* B.-S. Ann. & Mag. N. H. ser. 7, i. 1898, p. 14, pl. vi. fig. 1.

In Coll. Brit. Mus.

Hosts: gills of *Stromateus paru* [S. niger], *Polynemus tetradactylus*. Indian Ocean.

(5) Thysanote impudica. ♀ ♂.

Brachiella impudica Nordm. Mikrogr. Beiträge, ii. 1832, p. 92, pl. viii. fig. 1.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 513.
„ „ C. Vogt, Arch. Zool. Exp. xvi. 1877, p. 436.
„ „ B.-S. Jour. M. B. Assn. Plymouth, 1896, p. 162.

In Coll. Brit. Mus.

Hosts: gills of *Gadus æglefinus* and *Trigla* sp. Europe.

G. 2. Basanistes Nordm.

Cephalothorax distinctly separated from the body, and not attenuated. Genital segment quadrilateral or egg-shaped, with three rounded tubercles on either side. Second pair of maxillipeds short, united at the extremity, the first pair being placed at their base.

Young as an elegant free-swimming *Nauplius*.

(1) Basanistes huchonis. ♀.

Lernæa huchonis Schrank, Voyage in Bohême, p. 99, pl. i. fig. *a*.
„ „ Lamarck, Hist. des Anim. sans Vert. 1818, iii. p. 230.
Basanistes huchonis Nordm. Mikrogr. Beiträge, ii. 1832, p. 87.
„ „ Kollar, Ann. Wien. Mus. 1841, p. 86, pl. x.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 509.
Lernæopoda clavigera? Olsson, Oversigt Kgl. Ak. Forh. 1872, pl. v.

In Coll. Brit. Mus.

Host: gills of *Salmo hucho* and *Thymallus vulgaris*.

G. 3. Vanbenedenia Malm.

Head short, broader than long, not markedly attenuated, but plainly separated from the body. Body elongated, indistinctly segmented; no caudal appendages. External ovaries long, filiform. Second maxillipeds short and thick.

(1) Vanbenedenia kroeyeri. ♀.

Vanbenedenia kröyeri Malm, Förhand. Skand. Naturf. 1860, p. 620.

Host: gills of *Chimæra monstrosa*. Kattegat.

G. 4. Charopinus Kröyer.

Cephalothorax short, distinctly two-jointed. Second maxillipeds very long and slender, arm-like, with organ of attachment as hand-like clasping processes. Genital segment elongated, indistinctly segmented, terminating in two simple filiform processes. Abdomen rudimentary. External ovaries saccular.

Male minute; cephalothorax distinct; 2nd maxillipeds very large and cheliform; abdomen with 5 or 6 articulations.

(1) Charopinus ramosus. ♀ ♂.

Charopinus ramosus Kr. Bidrag til Kundskab, 1863, p. 284, pl. xiv. fig. 5.

Host: gills of *Raja clavata*. Europe.

(2) Charopinus dalmanni. ♀ ♂.

Lernæa dalmannii Retzius, Froriep's Notizen, xxix. 1831, p. 617, pl. vi. fig. 5.

Lernæopoda dalmannii Kr. Tidsskrift, i. 1837, p. 264, pl. ii. fig. 3.

" " M.-E. Hist. Nat. Crust. iii. 1840, p. 516.

Charopinus dalmannii Kr. Bidrag til Kundskab, 1863, p. 280, pl. xiv. fig. 6.

Host: gills of *Raja batis*. Europe.

(3) Charopinus hypocephalus. ♀.

Stylophorus hypocephalus Hesse, Ann. Sci. Nat. sér. 6, viii. 1878, art. 15, p. 1.

G. 5. Actheres Nordm.

Cephalothorax distinctly separated from the body, short, oval, one-jointed. Second maxillipeds long, slender, arm-like, united at the end, bearing a small disc of attachment. Body oval, distinctly segmented. External ovaries bag-like; ovules large.

(1) Actheres percarum. ♀.

Actheres percarum Nordm. Mikrog. Beiträge, 1832, p. 63, pl. i.

" " Kr. Tidsskrift, ii. 1838, p. 143, pl. iii. fig. 6.

" " M.-E. Hist. Nat. Crust. iii. 1840, p. 511, pl. xl. fig. 8.

Host: *Perca fluviatilis*.

(2) Actheres pimelodi. ♀.

Actheres pimelodi Kr. Bidrag til Kundskab, 1863, p. 272, pl. xvii. fig. 5.

Host: gills of *Pimelodes maculatus*. North America.

(3) Actheres lacæ. ♀.

Actheres lacæ Kllr.

" " Kr. Bidrag til Kundskab, 1863, p. 274, pl. xvii. fig. 6.

Host: *Perca laca*. North America.

(4) ACTHERES SELACHIORUM. ♀.

Actheres selachiorum Kurz, Zeitschrift wissens. Zool. xxix. 1877, p. 385, pl. xxv. fig. 1.

Host: *Mustelus lævis*, *Myliobatis aquila*.

G. 6. LERNÆOPODA Kröyer.

Cephalothorax short, single-jointed, stout, distinctly separated from the body. First maxillipeds placed not far behind the mouth. Second maxillipeds long, thin, arm-like, united at the end, bearing a disc of attachment. Genital segment elongated, bag-like, not segmented.

Male minute; cephalothorax distinct; abdomen elongated, segmented; articulate limbs present.

(1) LERNÆOPODA ELONGATA. ♀ ♂.

Lernæa elongata Grant, Edinb. Journ. of Science, vii. 1827, p. 147, pl. ii. fig. 5.
Lernæopoda elongata M.-E. Hist. Nat. Crust. iii. 1840, p. 515.
„ „ Baird, Brit. Entom. 1850, p. 333, pl. xxxv. fig. 5.
„ „ Stp. & Lütk. Bidrag til Kundskab, 1861, p. 422, pl. xv. fig. 37.
„ „ V. Ben. Rech. sur la Faune lit. Belg. 1861, p. 154.

In Coll. Brit. Mus.
Host: eye of Shark. Greenland.

(2) LERNÆOPODA STELLATA. ♀.

Lernæopoda stellata Mayor, Bull. de la Soc. Phil. 1824, p. 24, pl. i. fig. 2.
„ „ Rathke, Nova. Act. Acad. Cæs. Leop. 1839, p. 154.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 515, pl. xl. fig. 12.

Host:—? Norway.

(3) LERNÆOPODA GALEI. ♀ ♂.

Lernæopoda galei Kr. Tidsskrift, vol. i. 1837, p. 272, pl. iii. fig. 5.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 516.
„ „ Baird, Brit. Entom. 1850, p. 334, pl. xxxv. fig. 7.
„ „ V. Bened. Ann. des Sci. Nat. 3 ser. xvi. 1851, p. 120, pl. iv.
„ „ B.-S. Jour. M. B. Assn. Plymouth, 1896, p. 163.
„ *musteli* Thomson, Trans. N. Z. Inst. xxii. 1889, p. 373, pl. xxviii. fig. 9.

In Coll. Brit. Mus.
Hosts: fins of *Mustelus vulgaris*, *M. antarcticus*, *Squalus acanthus*, *Scyllium canicula*.

(4) LERNÆOPODA SEBASTES. ♀.

Lernæopoda sebastes Kr. Bidrag til Kundskab, 1863, p. 279, pl. xvii. fig. 7.

Host: gills of *Sebastes norvegicus*. Greenland.

(5) LERNÆOPODA OBESA. ♀.

Lernæopoda obesa Kr. Tidsskrift. vol. i. 1837, p. 270, pl. iii. fig. 13.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 516.

Host: *Squalus acanthias*.

(6) LERNÆOPODA SALMONEA. ♀.

Lernæa salmonea Linn. Fauna Suec. Ed. 2, 1761, p. 509, no. 2102.
„ „ Cordiner, Antiq. & Sc. of N. Scot. 7. 8, pl. vi. fig. 2.
„ „ O. Fabr. Faun. Grœnl. 337.
„ „ Müll. Zool. Dan. Prod. 2744.

Pediculus salmonis Gisler, Kongl. Svensk. Vetensk. Ak. Handling. 1751, p. 171, pl. viii. fig. 1.

Entomoda salmonea Lamarck, Hist. Anim. s. Vert. Ed. 2, 1818, p. 686.

Lernæopoda cyprinacea Hermann, Naturforsch. no. 19, 1783, pl. ii. fig. 7.
„ *salmonea* Blainv. Dict. Nat. xxvi. 1823, p. 127.
„ „ Mayor, Bull. des Sc. Soc. Phil. 1824, vol. xxiv.
„ *carpionis* Kr. Tidsskrift, i. 1837, p. 268, pl. ii. fig. 6.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 515.
„ *salmonea* Baird, Brit. Entom. 1850, p. 335, pl. xxxv. fig. 6.
„ „ Kr. Bidrag til Kund. 1863, p. 275, pl. xv. fig. 3.

Basanistes salmonea M.-E. Hist. Nat. Crust. iii. 1840, p. 509, pl. xli. fig. 3.

In Coll. Brit. Mus.

Host: *Salmo* spp., *Cyprinus leuciscus* [Leuciscus vulgaris].

G. 7. TRACHELIASTES Nordm.

Cephalothorax subcylindrical or cordate; mouth inferior; orbicular ciliated. Second maxillipeds long, arm-like, united at the ends, and provided with an organ of attachment. First maxilliped small, uncinate, at the base of the arms. Genital segment elongated, bag-like, not segmented, and without lobes or tubercles. Abdomen small. External ovaries saccular; ovules large.

(1) TRACHELIASTES POLYCOLOPHUS. ♀.

Trachelias tes polycolophus Nordm. Mikrog. Beiträge. ii. 1832, p. 95, pl. vii. figs. 1–8.
„ „ M.-E. Hist. Nat. Crust. iii. 1840, p. 507, pl. xl. figs. 1–7.

In Coll. Brit. Mus.

Host: gills of *Cyprinus jeses*.

(2) Tracheliastes maculatus. ♀.

Tracheliastes maculatus Kollar, Ann. Wien. Mus. i. 1841, p. 85.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 507.

Host: *Cyprinus brama* [Abramis brama].

(3) Tracheliastes stellifer. ♀.

Tracheliastes stellifer Kollar, op. cit. p. 82, pl. ix. fig. 8.
" " M.-E. op. cit. p. 508.

Host: *Silurus glanis*.

G. 8. Brachiella Cuv.

Cephalothorax markedly thin and elongated, vermiform. First maxilliped placed close behind mouth; second mostly long, arm-like, generally divided up to the ends, where is found the organ of attachment. Genital segment oval or quadrilateral. Abdomen simple.

Male. Pigmy, attached to body, neck, or maxillipeds of female. Cephalothorax distinctly divided from the long segmented abdomen by a marked constriction; both pairs of maxillipeds large, uncinate.

(1) Brachiella bispinosa. ♀ ♂.

Brachiella bispinosa Nordm. Mikrogr. Beiträge, 1832, p. 94, pl. viii. fig. 4.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 513.
" " C. Vogt, Arch. Zool. Exp. 1877, p. 426.
" *bicaudata*? Kr. Tidsskrift, i. 1837, p. 275, pl. iii. fig. 2.
" " M.-E. op. cit. p. 515.
" " B.-S. Journ. M. B. Assn. Plymouth, 1896, p. 163.

In Coll. Brit. Mus.

Host: gills of *Trigla* spp. Europe.

(2) Brachiella lophii. ♀.

Brachiella lophii M.-E. Hist. Nat. Crust. iii. 1840, p. 514, pl. xli. fig. 4.
" " C. Vogt, Arch. Zool. Exp. 1877, p. 426.

Host: *Lophius* sp. Naples.

(3) Brachiella rostrata. ♀.

Brachiella rostrata Kr. Tidsskrift, i. 1837, p. 207, pl. ii. fig. 1.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 514.
" " C. Vogt, Arch. Zool. Exp. 1877, p. 426.

In Coll. Brit. Mus.

Hosts: gills of *Pleuronectes pinguis*, *P.* [Rhombus] *maximus*, *Hippoglossus vulgaris*. North Sea, Greenland.

(4) Brachiella pastinacea. ♀.

Brachiella pastinacea V. Bened. Ann. Sci. Nat. 3 ser. xvi. 1851, p. 118, pl. iv. fig. 8.
" " C. Vogt. Arch. Zool. Exp. 1877, p. 426.
" " Kurz, Zeitschrift wiss. Zool. 1877, p. 389, pl. xxv. figs. 2, 3.

Host: nasal fossa of *Trygon pastinaca*.

(5) Brachiella parkeri. ♀.

Brachiella parkeri Thomson, Trans. N. Z. Inst. xxii. 1889, p. 374, pl. xxviii. fig. 8.

In Coll. Brit. Mus.

Hosts: *Raja nasuta* and *Trygon* sp. New Zealand.

(6) Brachiella malleus. ♀ ♂.

Brachiella malleus Nordm. Mikrogr. Beiträge, ii. 1832, p. 95.
" " C. Vogt, Arch. Zool. Exp. vi. 1877, p. 417.

Host: *Torpedo marmorata*.

(7) Brachiella insidiosa. ♀ ♂.

Brachiella insidiosa Heller, Reise der Novara, 1865, p. 239, pl. xxiv. fig. 1.
" " B.-S. Ann. & Mag. N. H. ser. 6, xviii. 1896, p. 14, pl. vi. fig. 2.

In Coll. Brit. Mus.

Hosts: *Gadus* sp. and *Gadus merluccius* [Merluccius vulgaris]. Mediterranean and Plymouth.

(8) Brachiella thynni. ♀ ♂.

Brachiella thynni Cuv. Règne Anim. iii. p. 287, pl. xv. fig. 5.
" " Guérin, Iconograph. Zool. pl. ix. fig. 2.
" " Nordm. Mikrogr. Beiträge, 1832, p. 90.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 512.
" " V. Bened. Ann. Sci. Nat. 3 ser. xvi. 1851, p. 128.
" " C. Vogt, Arch. Zool. Exp. vi. 1877, p. 426.
" " B.-S. Jour. M. B. Assn. Plymouth, 1896, p. 162.

In Coll. Brit. Mus.

Host: gills of *Thynnus thynnus*, *Sciæna aquila*. Plymouth, &c.

(9) Brachiella chaviesii. ♀ ♂.

Brachiella chaviesii V. Bened. Bull. Acad. Roy. de Belg. xxii. 1891, p. 23, pl. i.

Host: *Ceratopterus* sp. Azores.

(10) Brachiella chevreuxii. ♀ ♂.

Brachiella chevreuxii V. Bened. op. cit. p. 29, pl. ii.

Host:—? Senegal.

(11) BRACHIELLA MULTIFIMBRIATA. ♀ ♂.

Brachiella multifimbriata B.-S. Ann. & Mag. N. H. ser. 7, vol. ii. 1898, p. 96, pl. vi. fig. 2.

In Coll. Brit. Mus.

Host: gills of a *Serranus*. Muscat.

Second maxilliped united throughout, short.

(12) BRACHIELLA MERLUCCII. ♀ ♂.

Brachiella merluccii B.-S. Ann. & Mag. N. H. ser. 6, xviii. 1896, p. 14, pl. vi. fig. 1.

In Coll. Brit. Mus.

Host: *Gadus merluccius* [Merluccius vulgaris]. Plymouth.

(13) BRACHIELLA TRIGLÆ. ♀ ♂.

Brachiella triglæ Claus, Zur Morph. der Copep. 1860, pl. i. fig. 6.

Anchorella triglæ Kurz, Zeitsch. f. wiss. Zool. 1877, p. 404, pl. xxv. figs. 13–15.

Brachiella triglæ B.-S. Journ. M. B. Assn. Plymouth, 1896, p. 163.

Host: gills of *Trigla* spp.

G. 9. ANCHORELLA Cuv. (*Lernæomyzon* Blville.)

Cephalothorax markedly thin and elongated, worm-like. First maxilliped placed close behind the mouth, unciform; the second short, generally united together throughout, furnished at the extremity with the organ of attachment, often in the form of a drill. External ovaries saccular, ovules large.

Male. Pigmy; a globular cephalothorax with antennæ ciliated, mouth and large unciform maxillipeds, but apparently entirely destitute of abdominal segments.

(1) ANCHORELLA EMARGINATA. ♀ ♂.

Anchorella emarginata Kr. Tidsskrift, i. 1837, p. 287, pl. iii. fig. 7.
" " V. Bened. Ann. Sci. Nat. 1851, p. 113, pl. vi. fig. 4.
" " Kr. Bidrag til Kundskab, 1861, p. 309.
" " C. Vogt, Arch. Zool. Exp. xvi. 1877, p. 432.
" " Kurz, Zeitsch. f. wiss. Zool. xxix. 1877, p. 398, pl. xxv. fig. 8.
" " B.-S. Journ. M. B. Assn. Plymouth 1896, p. 163.
" *rugosa* Kr. Tidsskrift, i. 1837, p. 298, pl. iii. fig. vi.
" " M.-E. op. cit. p. 519.
" " V. Bened. op. cit. p. 114, pl. vi. fig. 7.

In Coll. Brit. Mus.

Hosts: gills of *Alosa finta* [Clupea finta] and *Anarrhichas lupus*. Europe.

(2) ANCHORELLA OVALIS. ♀.

Anchorella ovalis Kr. Tidsskrift, i. 1837, p. 289, pl. iii. fig. 6.
" " M.-E. Hist. Nat. Crust. iii. 1840, p. 519.
" " C. Vogt, Arch. Zool. Exp. xvi. 1877, p. 432.
Host: gills of *Trigla* sp.

(3) ANCHORELLA SCOMBRI. ♀.

Anchorella scombri Kurz, Zeitschrift f. wiss. Zool. xxix. 1877, p. 403, pl. xxv. fig. 12.
Host: gills of *Scomber scomber*.

(4) ANCHORELLA FALLAX. ♀.

Anchorella fallax Heller, Reise der Fregatte Novara, 1865, p. 241, pl. xxiv. fig. 4.
" *emarginata* M.-E. Hist. Nat. Crust. iii. 1840, p. 518.

(5) ANCHORELLA STELLATA. ♀.

Anchorella stellata Kr. Bidrag til Kundskab, 1863, p. 309.
" " C. Vogt, Arch. Zool. Exp. xvi. 1877, p. 432.
Host: gills of *Gadus merluccii* [Merluccius vulgaris].

(6) ANCHORELLA ANGULATA. ♀.

Anchorella angulata Kr. op. cit. 1863, p. 293, pl. xv. fig. 3.
" " C. Vogt, op. cit. 1877, p. 432.
Host: *Mugil* sp. Central America.

(7) ANCHORELLA PAGELLI. ♀.

Anchorella pagelli Kr. op. cit. 1863, p. 295, pl. xvi. fig. 3.
" " C. Vogt, op. cit. 1877, p. 432.
Host: *Pagellus* sp. Mediterranean.

(8) ANCHORELLA SARGI. ♀ ♂.

Anchorella sargi Kurz, Zeitschrift f. wiss. Zool. xxix. 1877, p. 393, pl. xxv. fig. 5.
Host: gills of *Sargus annularis*. Trieste.

(9) ANCHORELLA DENTICIS. ♀.

Anchorella denticis Kr. op. cit. 1863, p. 296, pl. xvi. fig. 4.
" " Heller, Reise der Fregatte Novara, 1865, p. 243.
" " C. Vogt, Arch. Zool. Exp. 1877, p. 432.
Host: gills of *Dentex argyrozona*.

(10) ANCHORELLA QUADRATA. ♀.

Anchorella quadratus B.-S. Ann. & Mag. N. H. 1896, p. 15, pl. iv. fig. 5.
Host: gills of *Callionymus lyra*. Plymouth.

(11) ANCHORELLA BREVICOLLIS. ♀.

Anchorella brevicollis M.-E. Hist. Nat. Crust. iii. 1840, p. 518.
„ „ C. Vogt, op. cit. 1877, p. 432.
Host: gills of *Gadus cellarius*.

(12) ANCHORELLA BERGYLTÆ. ♀.

Anchorella bergyltæ Kr. op. cit. 1863, p. 297, pl. xvi. fig. 5.
„ „ C. Vogt, op. cit. 1877, p. 432.
Host: gills of *Labrus bergylta* [L. maculatus].

(13) ANCHORELLA STICHÆI. ♀.

Anchorella stichæi Kr. op. cit. 1863, p. 298, pl. xvi. fig. 1.
„ „ C. Vogt, op. cit. 1877, p. 432.
Host: gills of *Stichæus punctatus*. Greenland.

(14) ANCHORELLA AGILIS. ♀.

Anchorella agilis Kr. op. cit. 1863, p. 300, pl. xvi. fig. 2.
„ „ C. Vogt, op. cit. 1877, p. 432.
Host: gills of *Gadus agilis* [G. fabricii]. Greenland.

(15) ANCHORELLA PAGRI. ♀.

Anchorella pagri Kr. op. cit. 1863, p. 301, pl. xvi. fig. 9.
„ „ C. Vogt, op. cit. 1877, p. 432.
Host: gills of *Pagrus vulgaris*. Mediterranean.

(16) ANCHORELLA CANTHARI. ♀.

Anchorella canthari Heller, Reise der Fregatte Novara, 1865, p. 242, pl. xxiv. fig. 6.
Host: gills of *Cantharus bleekeri*. Cape of Good Hope.

(17) ANCHORELLA UNCINATA. ♀ ♂.

Lernæa uncinata Müll. Zool. Dan. i. 1776, pl. xxxiii. fig. 2.
Schisturus uncinatus Oken, Lehrbuch der Natur. iii. 1815, p. 183.
Clavella uncinata Oken, op. cit.
Lernæomyzon uncinata Blville. Dict. Sc. Nat. xxvi. 1823, p. 122.
Anchorella uncinata Nordm. Mikrogr. Beitr. ii. 1832, p. 102, pl. viii. fig. 8.
„ „ Kr. Tidsskrift, i. 1837, p. 290, pl. iii. fig. 8.
„ „ M.-E. Hist. Nat. Crust. 1840, p. 519.
„ „ Baird, Brit. Entom. 1850, p. 377, pl. lxxxv. fig. 19.
„ „ V. Bened. Ann. Sci. Nat. 1851, p. 116, pl. vi. fig. 2.
„ „ C. Vogt, Arch. Zool. Exp. 1877, p. 428.
„ „ B.-S. Journ. M. B. Assn. Plymouth, 1896, p. 163.
„ „ Thompson, Trans. Liverp. Biol. Assn. 1893, p. 39, pl. xxvii. fig. 2.
In Coll. Brit. Mus.
Host: gills and mouth of *Gadidæ*. North Sea.

(18) ANCHORELLA DILATATA. ♀.

Anchorella dilatata Kr. op. cit. 1863, p. 302, pl. xv. fig. 2.
„ „ C. Vogt, op. cit. 1877, p. 432.
Host: gills of *Chilodactylus* sp. Cape of Good Hope.

(19) ANCHORELLA PARADOXA. ♀ ♂.

Anchorella paradoxa V. Ben. Ann. Sci. Nat. 1851, p. 117, pl. vi. fig. 1.
„ „ C. Vogt, op. cit. 1877, p. 432.
„ „ B.-S. Ann. & Mag. Nat. Hist. ser. 6, xviii. 1896, p. 15, pl. v. fig. 2.
In Coll. Brit. Mus.
Host: gills of *Scomber scomber*. Plymouth.

(20) ANCHORELLA HOSTILIS. ♀.

Anchorella hostilis Heller, Reise der Fregatte Novara, 1865, p. 243, pl. xxiv. fig. 7.
„ „ Kurz, Zeitschrift f. wiss. Zool. xxix. 1877, p. 391, pl. xxv. fig. 4.
Host: gills of *Umbrina cirrhosa*. Mediterranean.

(21) ANCHORELLA SCIÆNOPHILA. ♀.

Anchorella sciænophila Heller, op. cit. 1865, p. 243, pl. xxiv. fig. 8.
Host: gills of *Sciæna* sp. Indian Ocean.

(22) ANCHORELLA APPENDICULATA. ♀.

Anchorella appendiculata Kr. Bidrag til Kundskab, 1863, p. 305, pl. xvi. fig. 7.
„ „ C. Vogt, op. cit. 1877, p. 432.
Host:—? Valparaiso.

(23) ANCHORELLA LANCINIATA. ♀.

Anchorella lanciniata Kr. op. cit. 1863, p. 308, pl. xvi. fig. 8.
„ „ C. Vogt, op. cit. 1877, p. 432.
Host: gills of *Acanthurus chirurgus*. W. Indies.
Second maxillipeds not united throughout.

(24) ANCHORELLA (?) UROLOPHI. ♀.

Anchorella urolophi Kr. op. cit. 1863, p. 304, pl. xvi. fig. 10.
„ „ C. Vogt, op. cit. 1877, p. 432.
Host: gills of *Urolophus oerstedii*. Mexico.

(25) ANCHORELLA (?) APPENDICULOSA. ♀.

Anchorella? appendiculosa Kr. op. cit. 1863, p. 306, pl. xvi. fig. 6.
„ „ C. Vogt, op. cit. 1877, p. 432.
Host: *Corvina* sp., *Pagellus* sp. New Orleans.

G. 10. Cestopoda Kurz.

Female with elongated cylindrical cephalothorax, enlarged squarish genital segments, and minute abdomen. The ovaries are lateral, enclosed in muscular bands which are united together down the centre by a membrane. Second pair of maxillipeds short, double, muscular, serving as an organ by which the animal fixes itself to its host.

(1) Cestopoda amplectens. ♀.

Cestopoda amplectens Kurz, Zeitschrift f. wiss. Zool. xxix. 1877, p. 407, pl. xxiv.

Host: gills of *Sargus annularis*. Adriatic.

(2) Cestopoda lizæ. ♀.

Anchorella lizæ Kr. Bidrag til Kundskab, 1863, p. 295, pl. xvi. fig. 2.

Cestopoda lizæ Kurz, op. cit. 1877, p. 415.

Anchorella lizæ Carl Vogt, Arch. Zool. Exp. vi. 1877, p. 432.

Host: gills of *Mugil liza*. New Orleans.

(3) Cestopoda cygniformis. ♀.

Naobranchia cygniforme Hesse, Ann. Sci. Nat. 4 ser. xx. p. 122, 1863.

„ „ Heller, Reise der Fregatte Novara, 1865, p. 244.

Host: *Pagellus erythrinus*. North Sea.

Summary of the Genera and Species.

Family.	Page.	Genera.	Species.
i. Ergasilidæ	441	2	22
ii. Caligidæ	444	25	124
iii. Dichelestidæ	468	15	46
iv. Philichthyidæ	477	5	14
v. Lernæidæ	480	11	38
vi. Chondracanthidæ ..	488	9	32
vii. Lernæopodidæ	496	10	62
	Total..	77	338

EXPLANATION OF PLATE XXVI.

Fig. 1. *Oralien asellinus*, ♀, p. 490. Dorsal surface. 1 *a*. Ventral surface. 1 *b*. Anterior part of head with antennæ. 1 *c*. Posterior portion. with mouth.

2. *Philichthys xiphiæ*, ♀, p. 478. 2 *a*. ♂ of same.

3. *Richiardia denticis*, ♀, p. 479. $\frac{15}{1}$.

4. *Sphærifer leydigi*, ♀, p. 479. $\frac{10}{1}$.

5. *Colobomatus bergyltæ*, ♀, p. 480. $\frac{16}{1}$. 5 *a*. The same seen from the side.

6. *Lepeophilus labri*, ♀, p. 480. $\frac{15}{1}$.

2. On the Ornis of the State of São Paulo, Brazil.

By H. von Ihering, C.M.Z.S.

[Received March 3, 1899.]

(Plate XXVII.)

Since my paper "As aves do Estado do São Paulo" (Revista do Museu Paulista, vol. iii. São Paulo, 1898, pp. 113–476) is written in Portuguese, I believe it may be useful to offer to the Zoological Society of London an account of the general results at which I have arrived on this subject.

The studies made by me during the past six years on the Ornis of this State have led to conclusions concerning the geographical distribution of its Birds which differ essentially from those published by Pelzeln in his work on the Birds collected by Natterer. It is necessary to distinguish between the material results due to the efforts of Natterer, the most successful of all those who have ever collected in South America, and the generalizations on geographical provinces based by Pelzeln on Natterer's collections, which seem to me to be unsatisfactory. It is true that with reference to São Paulo, Pelzeln has noted the extension of the Minas and Matto-Grosso faunistic element into this State, but he has established artificial zoo-geographical boundaries, and has not noticed those really existing.

I do not wish to be understood as in any way underestimating Pelzeln's valuable memoir, but Science progresses and often modifies previous results. The work of Pelzeln was based essentially upon the collections of Natterer; and Natterer travelled neither in the States of Sta. Catharina and Rio Grande do Sul, nor in the littoral zone between Rio and Pará. The lists given by Pelzeln have been greatly modified and augmented by my paper above referred to and by other recent publications; and the marked differences between the highland and the coastal lowland of São Paulo were not noticed by Natterer and Pelzeln.

There is another reason for the differences between Pelzeln and myself. Pelzeln used a statistical method to define the different regions which he created, by compiling lists of the birds found in one, two, or more of his regions. I believe that accurate material is not yet available for this kind of work. This method is that of abstractions and generalizations, as used by Wallace, Sclater, and other great masters of Zoo-geography. But besides this method we can use another, that of studying analytically the different elements of the fauna of a restricted area and discovering its zoo-geographical boundary-lines. This course I have taken in studying the fauna of Rio Grande do Sul, thus verifying the different zoo-geographical boundaries; and a similar result has been obtained from my studies on the fauna of São Paulo. These boundaries are of secondary importance, marking natural divisions in the greater Zoo-geographical Provinces: as, however, they are not artificial but natural boundaries, it is important to discover them.

ORNIS OF THE STATE OF SÃO PAULO, BRAZIL.

F.S.Weller F.R.G.S.

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Evidence of this is given by the fact that Pelzeln has not mentioned the line which coincides with the boundary between the States of Paraná and São Paulo. Although some of the more striking pieces of evidence of this line have been given only in my paper, others are due to Natterer's collections. This line marks the northern limits of a number of Argentine species which occur in the three southernmost States of Brazil, but do not extend north of it into São Paulo and Rio. Besides certain characteristic species, such genera as *Cyanotis*, *Phlœocryptes*, *Anumbius*, *Cliban-ornis* and *Haplospiza* characterize this "*Anumbius*-line," as it may be named.

I cannot forbear to mention that I have been astonished to find that such results as those I have arrived at on the faunistic boundary-lines in Rio Grande do Sul should have been disregarded by zoologists. However, I shall continue to work on in the same manner, and if with this help there cannot be constructed a complete system, we shall obtain at any rate exact data for the analysis of the faunas of some of the States; and if the same task be undertaken in other States of Brazil, the results must without doubt be satisfactory—as a piece of mosaic-work, but a definite one. It is evident that such work can only be the result of extensive and exact explorations of restricted areas, and more of it is to be expected from Museums than from observers, who spend but a short time in one country. I hope that Dr. Goeldi, continuing his work in the Pará Museum, will investigate the State of Pará in the same manner.

In concluding these general remarks, I wish to state, as the result of my studies, that South-eastern Brazil, from Rio Grande do Sul to Bahia, and probably farther northward, forms a natural province of the Neotropical Region, which contains two Sub-divisions (see Map, Plate XXVII.). One of these extends from Rio Grande do Sul to Rio de Janeiro; the other from the North down to São Paulo. The northern Subdivision extends along the coast of São Paulo to Iguape and probably farther southward, but is here restricted to a narrow coast-zone. This is separated by a narrow chain of mountains from the highlands, and these high-lands towards the west pass into campos, which have the same fauna as the campos of Minas, Goyaz, and Matto Grosso. We have, therefore, in São Paulo three faunistic subdivisions, repre-senting from the west to the coast successively the central, marginal, and littoral fauna. The two last are separated by the Serra do Mar, which is only a few miles broad, but supplies a difference of altitude of more than 700 mètres and a difference of temperature of 3° C. or more. This is the reason why many Bahia species which do not occur in the interior of São Paulo are found along the coast.

I now proceed to the special discussion of my paper and its zoo-geographical results.

There are two new species described in my paper—*Chrysotis schmidti*, closely allied to *Ch. auripalliata*, but with the bend of

the wing green instead of red; and *Crax sulcirostris*, with a large sulcus descending longitudinally on each side of the beak. Both are apparently from near the mouth of the Tieté River. Colonel C. Schmidt, of Rio Claro, has informed me that the *Chrysotis* is common in that part of the Tieté, and is called "*Papagaio inglez*." I have described the two species in order to call attention to them. I have sent some other specimens which may belong to new species to the British Museum and Count Berlepsch. That in a fauna of nearly 600 species so few only are new to science shows how much work has already been done on the Ornithology of South-eastern Brazil. Besides the two new species, the following are restricted to the province of São Paulo, if I am correctly informed:—

1. *Basileuterus leucophrys* Pelz.
2. *Spermophila melanogaster* Pelz.
3. *Hapalocercus rufomarginatus* Pelz.
4. *Anabazenops amaurotis* (Temm.).
5. *Eucephala cæruleo-lavata* Gould.
6. *Ptochoptera iolæma* (Reich.).
7. *Astur poliogaster* (Temm.).
8. *Stenopsis platura* Pelz.

These seem to be essentially species of the Western Zone of the State, where we have hitherto made no collections, and this may be the reason why I have not yet obtained these rare forms, with the exception of the *Stenopsis*. Of this species Natterer collected only the female, and as my specimen is a male, the question whether this is a good species has been decided in favour of Natterer. Possibly one or more of these species may be recognized as having been previously described; as may also be the case with *Astur poliogaster*.

Then there is a series of other species which seem to occur only in São Paulo and Rio de Janeiro; such as *Ceratotriccus furcatus* (Lafr.), *Pogonotriccus eximius* (Temm.), *Elainea caniceps* (Sw.), *Lathria virusu* Pelz., *Biatas nigropectus* (Lafr.), *Cephalolepis delalandii* (Vieill.), and *Macropsalis creagra* (Bp.). It is very probable that all these species have really a wider distribution, as statements of their occurrence may have been overlooked by me. It is also to be presumed that, with the progress of the ornithological explorations of Brazil, they may be found in some of the adjoining States.

In contrast to these species of restricted occurrence, there are very many others of wide distribution in our Avifauna.

Of the species enumerated in my list, ninety-three occur all through Brazil, from its southern boundary to Pará, sixty-eight in Brazil and in other parts of South America, twenty-nine in South and North America, and eight are of an almost cosmopolitan distribution. These eight are *Strix flammea*, *Nycticorax nycticorax nævius*, *Arenaria interpres*, *Charadrius dominicus*, *Gelochelidon anglica*, *Sterna maxima*, *Oceanites oceanicus*, and *Majaqueus æquinoctialis*. Altogether there are 198 species of wide distribution; that is, about one-third of all the species occurring in São Paulo. The number of widely dispersed species is very different in the various orders. If the two species of *Ceophlœus* ought to be united into one, there is no species of the order *Pici* occurring throughout

the whole of Brazil. On the contrary, in the orders *Steganopodes* and *Limicolæ*, all the species enumerated are of very wide distribution, there being very few of the occurrence of which, in Sta. Catharina and Rio Grande do Sul, I am uncertain, namely *Anhinga anhinga*, *Tringoides macularius*, and *Hoploxypterus cayanus*. The proportion of widely distributed species of birds which occur in São Paulo may be readily seen from the following estimated percentage:—*Pici*, 0 per cent.; *Clamatores*, 15 per cent.; *Psittaci*, 20 per cent.; *Oscines*, 24 per cent.; *Accipitres*, 63 per cent.; *Striges*, 80 per cent.; *Steganopodes* and *Limicolæ*, 100 per cent. It is quite evident therefore that, for the discussion of geographical distribution, the value of the different orders is quite unequal, and that most of them have little, if any, importance as regards our knowledge of the Zoo-geographical Provinces of Brazil.

The difficulty of the study of the different zoo-geographical zones which are distinguishable in the State of São Paulo, is due to the fact that we have not only to separate northern and southern elements, but also western, which represent the fauna of Goyaz and Minas advancing beyond its borders. Pelzeln first noted this fact, but his demarcating lines are merely imaginary and without sufficient foundation.

The number of species belonging to this Central Fauna in São Paulo is estimated by me as about seventy. I may mention as some of its characteristic species:—*Rhamphocœlus jacapa*, *Tachyphonus melaleucus*, *Icterus pyrrhopterus*, *Nemosia pileata* and *N. guira*, *Brotogerys chiriri*, *Thalurania eriphile*, *Stenopsis candicans*, and *Nothura media*; and as typical genera, *Polioptila*, *Agelæus*, *Icterus*, *Tiaris*, *Tœnioptera*, *Muscipipra*, *Hapalocercus*, *Habrura*, *Piprites*, *Metopia*, *Casiornis*, *Geobates*, *Herpsilochmus*, *Lepidolarynx*, *Campylopterus*, *Eupetomena*, *Heliactin*, *Galbula*, *Brachygalba*, and *Taoniscus*.

I believe that we ought to add to this list the species of *Corvidæ*, the genera *Anadorhynchus* and *Ara*, and some species of *Chrysotis*, such as *C. æstiva*. It seems that some of these western species are at the present time occupying parts of São Paulo, where they were not represented in the beginning of the present century; as I shall point out in the case of *Furnarius rufus*.

A great number of these species of the Central Fauna are birds of the campos; but it would be quite wrong to suppose that this is a universal feature, as in Goyaz and Matto-Grosso, as also in São Paulo, the Central Fauna includes both campos and forest birds. The last-named birds follow the River Paraná, and, in São Paulo, its confluents the rivers Tieté and Paranapanema.

The avifauna at the mouth of the Tieté River, at Itapura, is that of Matto-Grosso and Goyaz; and this fauna extends from Itapura to Avanhandava, at the mouth of the Rio Morto, and probably farther up. I have no personal experience of it, but I have received good information on the subject from intelligent Brazilian hunters.

The occurrence of such notable forms as *Ara chloroptera* and

A. ararauna, *Anadorhynchus hyacinthinus* and others, is of decisive importance, and the same Aras ascend the Paranapanema River a great distance up. I may observe, however, that I have sufficient knowledge of the birds of Tieté and Piracicaba, to say that the ornis there is the same as that of São Paulo, without reference to differences of secondary importance.

We do not know the exact extension of the Goyaz elements along the Paranapanema River, but there are facts which make us believe that many tropical forms may have migrated along this river, definitely or temporarily, to the Ribeira River, and to the neighbourhood of Ypanema. It is quite possible that some tropical species, found by Natterer in 1820 at Ypanema, do not now live there, the character of the country having been greatly modified by culture. I was not able to obtain from the district of Ypanema species of *Holochilus* and other Rodents captured there by Natterer; but on the contrary there is now common there, as well as at São Paulo, *Hesperomys* (*Nectomys*) *sciureus* Wagn., which does not seem to be represented in the extensive collections made by Natterer. I believe that, as is the case with the *Furnarius*, this species has attained its present wide distribution in the State of São Paulo since the time of Natterer. *Furnarius rufus* is a species common in the campos of Rio Grande do Sul and Argentina, and occurs in São Paulo in the western regions, and in the valley of the Parahyba River. I am informed by Major Cornelio Vieira do Camargo that this bird made its appearance in the municipality of Tatuhy about twenty years ago. Natterer, in 1819–1822, obtained no specimens in the State of S. Paulo. In his list is registered a specimen from Rio, but erroneously; for Mr. Euler informs me that this bird does not occur in Rio de Janeiro at all. This species which, as we can hardly doubt, has in this country extended its area in a very remarkable manner into the State of São Paulo, occurs neither in the vicinity of the capital of the State nor in the littoral belt. It is therefore an element of the Central Fauna, immigrated into the intermediary zone; and it is a matter of further research to verify the other species which are in the same condition.

Polioptila dumicola is an element of the Central Fauna which Natterer obtained on the Rio Paraná. It seems reasonable to suppose that the case of *P. leucogaster* would be the same, but as this species occurs also at Iguape, Rio, and Bahia, another explanation must be given.

Besides this central element, we have to distinguish species of São Paulo which are mainly found south of Rio and São Paulo, and others belonging to the Bahia-Rio district which in certain localities extend into the territory of São Paulo.

This southern element contains some species which extend from Buenos Ayres to Rio de Janeiro, such as *Stephanophorus cæruleus*, *Cnipolegus cyanirostris*, *Hemitriccus diops*, *Serphophaga nigricans*, and *Limnopardalis rhytirhynchus*. Besides these, there are others which occur from Argentina to São Paulo, as *Cistothorus polyglottus*, *Haplospiza unicolor*, *Coryphospiza albifrons*, *Serphophaga*

subcristata, *Culicivora stenura*, *Cyanotis azaræ*, *Anumbius acuticaudus*, *Furnarius rufus*, *Phlœocryptes melanops*, *Thamnophilus maculatus*, *T. ruficapillus*, *Ardea sibilatrix*, *Ardetta involucris*, *Plegadis guarauna*, *Dafila spinicauda*, and *Fulica armillata*. There are also some marine or coast-birds which occur as temporary residents on the São Paulo coast, such as *Cygnus melanocoryphus* and *Spheniscus magellanicus*.

Of species occurring between Rio Grande do Sul and São Paulo, I may mention: *Calliste pretiosa*, *Cyanocorax cæruleus*, *Cybernetes yetaba*, *Thripophaga sclateri*, *Heliobletus contaminatus* Pelz. (=*superciliosus* Licht.), *Picolaptes falcinellus*, *Trogon surucura*, *Chrysotis brasiliensis*, and *Chrysotis pretrii*.

Some of the species that occur in São Paulo and Rio are known from Sta. Catharina, but I have no data to prove that they also occur in Rio Grande do Sul. Such are *Dacnis cayana* and *D. nigripes*, *Tanagra ornata* and *T. palmarum*, *Cissopis major*, *Cassicus hæmorrhous*, *Cassidix oryzivora*, *Oxyrhamphus flammiceps*, *Ilicura militaris*, *Tijuca nigra*, *Malacoptila torquata*, and *Andigena bailloni*.

Many of the Sta. Catharina species not as yet obtained in Rio Grande do Sul may probably be found there still; but it seems quite possible that others (*Tanagra palmarum*, *Ceryle inda*, *Dacnis*, etc.) do not pass southwards of Sta. Catharina. I have never seen any *Dacnis* in the State of Rio Grande do Sul. The locality in the British Museum Catalogue, "Pelotas, Rio Grande do Sul (*Joyner*)," is wrong.

I now give a list of the species that occur between Rio Grande do Sul and Rio de Janeiro; and which, I believe, do not extend their distribution north of Rio. These are:—

Euphonia pectoralis.
Hypophœa chalybœa.
Chlorophonia viridis.
Tachyphonus coronatus.
Arremon semitorquatus.
Aphobus chopi.
Cnipolegus nigerrimus.
Orchilus auricularis.
Alectrurus tricolor.
Mionectes rufiventris.
Phyllomyias brevirostris.
Phyllomyias burmeisteri.
Sirystes sibilator.
Phibalura flavirostris.
Ampelion cucullatus.
Anabazenops rufo-superciliatus.
Sittosomus erithacus.
Dendrocolaptes picumnus.
Batara cinerea.
Thamnophilus leachi.
Thamnophilus severus.
Leucochloris albicollis.
Phaëthornis eurynome.
Clytolæma rubinea.
Rhamphastos dicolorus.
Pyrrhura vittata.
Triclaria cyanogastra.
Leucopternis palliata.
Leucopternis lacernulata.
Penelope obscura.
Crypturus obsoletus.

It thus seems that the fauna of Southern Brazil, from Rio de Janeiro to Rio Grande do Sul, has a great number of characteristic species and even genera. The latter are:—(*a*) *Culicivora*,

Hemitriccus, *Heliobletus*, *Batara*, *Phibalura*, *Stephanophorus*, *Hypophæa*, *Orthogonys*, *Leucochloris*, and *Triclaria*; and (*b*) *Cnipolegus*, *Cybernetes*, *Alectrurus*, *Cyanotis*, *Phlœocryptes*, *Anumbius*, and *Coryphospiza*.

The first group includes what are essentially South Brazilian genera; the second those of Argentina, which, advancing north, enter Southern Brazil. Many of the Argentine species occur in São Paulo at Itararé and Rio Verde only, on the boundary of the State of Paraná. To these it will be convenient to add some other species not yet observed in São Paulo, such as *Tœnioptera dominicana* Vieill., *Piprites pileatus* (Temm.), *Leptasthenura striolata* Pelz., *Siptornis ruticilla* (Licht.), *Phacellodomus striaticollis* (Lafr. & d'Orb.), and *Clibanornis dendrocolaptoides* (Pelz.).

It is a fact of zoo-geographical interest, that the boundary between São Paulo and Paraná corresponds to a faunistic line which is not transgressed by many birds characteristic of the Argentine Pampas.

Of special interest is the occurrence of *Cyanotis azaræ* and *Phlœocryptes melanops*—typical Patagonian birds which are likewise found in Chili, Rio Grande do Sul, and Bolivia. We have received from Iguape not only these birds but also their nests. These two birds accompany each other and occur in reedy swamps. It may be that they are resident at Iguape only in the summer; but it is also possible that they have been resident there since the time when the coast extended more to the east, and lowlands with marshes and lagoons occupied that part of the ocean which connects Rio Grande with Iguape.

We have many singular facts which tend to this conclusion. *Azara labiata* and *Paludestrina* are brackish-water species of mollusks, common from Iguape to Buenos Ayres; and again, *Chilina fluminea* and *Glabaris exotica*, of the fresh-waters of Iguape, are species characteristic of Rio Grande do Sul and Argentina, which are not found at all in the central and northern parts of the State of São Paulo (see my papers on the Geographical Distribution of the Freshwater Fauna of Southern Brazil). I cannot accept the explanations given by Dr. Ortmann, who says that the *Potamoniidæ* do not coexist with the *Parastacidæ* because of the effects of the struggle for life. In Rio Grande do Sul they do coexist, and I have observed that they cannot enter in competition, since they are quite different in their mode of life. The only satisfactory explanation is that based upon terrestrial modifications, as suggested above; and it seems to me that *Cyanotis* and *Phlœocryptes*, bad fliers as they are, must be considered, from the same point of view, as being relicts.

Cygnus melanocoryphus sometimes appears on the coast near Iguape. A curious fact is the appearance of a Penguin, *Spheniscus magellanicus*, on the coasts of Paraná and São Paulo. I am informed that last winter, during July and August 1898, thousands of dead Penguins were observed there. We have received

specimens from Iguape, Santos, and São Sebastião; but I see by the newspapers, that some have also been captured on the coast of Espiritu Santo. I observed this Penguin on the coast of Rio Grande do Sul in 1883. The extension of its winter excursions to the coast of São Paulo dates back only three or four years.

The northern element of the São Paulo Avifauna is very large, and has been considerably increased by my investigations.

From the littoral zone especially, *i. e.* Iguape, we have obtained examples of a number of common Bahia birds, not hitherto known to occur in São Paulo. These are such species as *Donacobius atricapillus*, *Dacnis speciosa*, *Tanagra palmarum*, *Thryophilus longior*, *Rhamphocœlus brasilius*, *Sycalis flaveola*, *Elainea pagana*, *Lathria virussu*, *Dendrocincla turdina*, *Formicivora rufatra*, *F. ferruginea*, *F. squamata*, *Rhamphocœnus melanurus*, *Formicarius colma*, *Merulaxis rhinolophus*, *Agyrtria tephrocephala*, *Pyrrhura leucotis*, *Urochroma wiedi*, *Cancroma cochlearia*, and *Guara rubra*.

As genera of this northern element which are not found southward of the State of São Paulo, we may name:—*Thryophilus*, *Donacobius*, *Rhamphocœlus*, *Capsiempis*, *Legatus*, *Myiozetetes*, *Rhynchocyclus*, *Conopias*, *Megarhynchus*, *Muscivora*, *Myiochanes*, *Ptilochloris*, *Chiromachœris*, *Neopelma*, *Hadrostomus*, *Attila*, *Philydor*, *Biatas*, *Corythopis*, *Lathria*, *Dendrocincla*, *Rhamphocœnus*, *Formicarius*, *Merulaxis*, *Florisuga*, *Nonnula*, *Jacamaralcyon*, *Bucco*, *Urochroma*, *Busarellus*, *Buteogallus*, *Thrasaëtus*, *Leptodon*, *Anhinga*, *Scardafella*, *Crax*, *Porzana*, *Porphyriola*, *Palamedea*, *Cancroma*, and *Guara*.

To these may possibly be added *Lipaugus simplex* and *Pipra leucocilla*, mentioned from São Paulo without exact localities by Joyner, but not met with by other observers.

It may be useful to add here the names of species observed by Euler at Cantagallo, in the State of Rio, which hitherto have not been observed in São Paulo, namely:—*Atticora tibialis* Cass. (perhaps an erroneous determination), *Chlorophanes spiza*, *Nemosia flavicollis*, *Thlypopsis sordida*, *Pitylus brasiliensis*, *Phonipara fuliginosa*, *Coryphospingus pileatus*, *Icterus tibialis*, *Alectrurus risorius*, *Euscarthmus limbatus*, *Phyllomyias griseocapilla*, *Pipra rubricapilla*, *Machæropterus regulus*, *Cotinga cincta*, *Calyptura cristata*, *Picolaptes squamatus*, *Thamnophili doliatus*, *palliatus*, *torquatus*, and *ambiguus*, *Myrmotherula melanogaster* and *M. brevicauda*, *Terenura maculata*, *Myrmeciza loricata*, *Percnostola funebris*, *Conopophaga melanops*, *Glaucis hirsuta*, *Hylocharis cyanea*, *Pygmornis pygmœus*, *Prymnacantha langsdorffi*, *Chloronerpes brasiliensis*, *Dendrobates maculifrons*, *Chelidoptera tenebrosa brasiliensis*, *Neomorphus geoffroyi*, *Chrysotis farinosa*, *Asturina nitida*, *Morphnus guyanensis*, *Harpagus bidentatus*, *Falco aurantius*, and *Crypturus pileatus*.

It is possible that some of these species may occur in the littoral zone of São Paulo also; but many of them are certainly absent there, as, for example, *Cotinga cincta* and *Pipra rubricilla*. *Trogon aurantius* of Rio and Northern Brazil is in São Paulo replaced by

Trogon surucura. Natterer obtained *T. aurantius* at Monjolinha in the State of São Paulo; but this locality is situated on the confines of Rio de Janeiro.

In the same manner *Picolaptes falcinellus* of São Paulo is replaced in Rio by *P. squamatus*; *Myrmeciza squamosa* by *M. loricata*; *Conopophaga nigrigenys* by *C. melanops*; and *Dendrobates spilogaster* by *D. affinis*.

São Paulo and Santos are situated a little distance apart, but the difference in elevation (760 m.) effects a difference of 3° C. in the mean annual temperature. This explains why many Bahia species extend to Iguape, but are not found in São Paulo. Yet some of these species occur in the western regions of São Paulo, along the Paraná River, at 21° South latitude.

From the Rio Paraná Natterer obtained examples of such species as *Tanagra palmarum*, *Donacobius atricapillus*, *Dacnis speciosa*, and *Polioptila leucogastra*, which we have received from Iguape and which also occur in Rio and Bahia, but not in São Paulo. This is probably also true of *Cyclorhis wiedi*, but this species has not been observed at Rio de Janeiro; and it probably represents a Matto-Grosso form which, at Iguape and in Bahia, has reached the coast-zone. *Basileuterus hypoleucus* is another species from Minas and Goyaz observed at Ypanema by Natterer. *Machetornis rixosa* has not been met with in the State of São Paulo, but perhaps occurs in the western zone. In the States of Rio Grande do Sul and Bahia it is, however, a member of the littoral fauna, due to the extension in these States of the central campos to the coast.

In some cases it is easy to separate the different faunistic elements of the genera of the São Paulo ornis. *Tachyphonus melaleucus* occurs in the western zone of São Paulo; *T. coronatus* is distributed from Rio Grande do Sul to Rio; and *T. cristatus* ranges from Northern Brazil to Rio and Iguape. Amongst the species of *Euscarthmus*, *E. gularis* is a southern form, occurring from Rio Grande do Sul to Rio. *E. fumifrons* and *E. pelzelni* are Matto-Grosso birds, occurring along the Paraná River; and *E. nidipendulus* and *E. orbitatus* are species of Bahia and Rio which extend into São Paulo.

Species of the western element which extend their distribution to Ypanema and the Ribeira River present some difficulty. I consider all the species not observed in the littoral districts of Southern Brazil, extending north and south of São Paulo, as members of the Western fauna which have come along the Paranapanema River either to the littoral or to the marginal zone. Naturally, it will be only possible to decide such questions when their geographical distribution is exactly known. As, however, the fauna of Rio de Janeiro is well represented in the larger museums, and has been examined by numerous naturalists, I believe that there are really a number of North-Brazilian species which occur in the littoral at Bahia, but not at Rio, and which extend to the western region of São Paulo.

One more example may be given. We have various specimens

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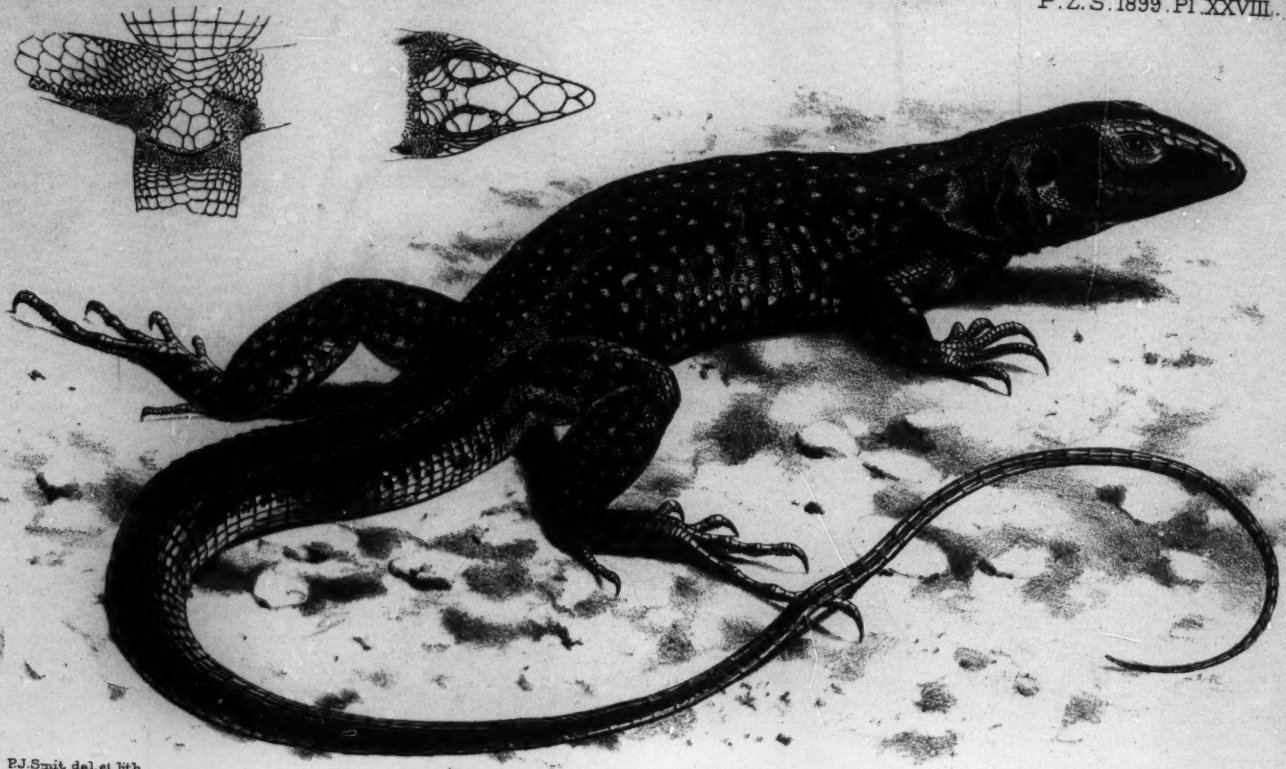


P.J.Smit del. et lith.

AMEIVA LEUCOSTIGMA.

Mintern Bros. imp.

of *Cancroma cochlearia*, which seems to be a permanent resident near the mouth of the Tieté River. It is certain that this bird was obtained by Mr. Krone at Iguape. It is also certain that the Red Ibis (*Guara rubra*) sometimes occurs in the summer at Iguape and also at Paranagua. It is possible that *Cancroma*, like *Guara*, is a coast-bird sometimes extending its migrations to the south of São Paulo. It is evident that in this case *Cancroma* would be more common at Rio than here. If this be not the case, then the Iguape specimens of *Cancroma* may be derived from the Paranapanema system, and have passed thus to the Ribeira River. The exploration of the avifauna of the tropical parts of the Rivers Paranapanema and Tieté is, therefore, one of the most pressing conditions for the advancement of the study of the São Paulo ornis. As the collection in the British Museum is said to include *Cancroma* from Rio de Janeiro, the specimens from Iguape may belong to the Coast ornis.

I must not here enter into discussions for which I have not such sufficient material as for the ornis of São Paulo; but I may at least say that the contrast in which the conclusions of Pelzeln stand to facts, as here shown, has also made me very sceptical concerning his other divisions and districts.

In Rio Grande do Sul there exists a notable contrast between the fauna of the coast-region and that of the Missiones of the Uruguay. *Chrysotis æstiva* is found there with species of *Ara* etc., and also the monkey *Mycetes niger*. This contrast exists also in São Paulo; and I am much disposed to consider these differences as more important than those observed between the northern and southern parts of the littoral zone. If this should be the case, we have three great faunal subregions of Brazil—the Amazonian, the Central, and the South-eastern.

EXPLANATION OF PLATE XXVII.

Map of South America, showing the South-eastern Brazilian Province and its division into three Sub-provinces—Central (*blue*), Northern (*yellow*), and Southern (*red*).

3. Description of a new Lizard of the Genus *Ameiva* from Ecuador. By G. A. Boulenger, F.R.S.

[Received March 30, 1899.]

(Plate XXVIII.)

Ameiva leucostigma, n. sp.

Nostril in the posterior part of the anterior nasal; four supraoculars, the first of which may be broken up into scales, the three others bordered on both sides with granules, or the second in contact with the frontal; six supraciliaries; a single frontoparietal, followed by an interparietal; parietals broken up into small shields;

a large loreal and two small superposed freno-orbitals; 7 or 8 upper labials; chin-shields, one anterior and 4 to 6 pairs; no enlarged median gulars; mesoptychial scales small. Dorsal scales minute, granular; ventral plates in 8 longitudinal rows, subequal in width, about twice as broad as long; 32 to 35 plates from the collar-fold to the præanal region. 6 enlarged præanal plates, one in the first row, two in the second, three in the third. One row of large brachial plates, followed by rows of smaller ones gradually merging into granular scales; two rows of large antebrachials, the outer continuous with the brachials. 4 or 5 rows of femoral shields, 3 of tibials. 18 to 21 femoral pores on each side. Toes conspicuously serrated at the base. Caudal scales slightly oblique, upper sharply keeled. Blackish above, body and limbs with numerous small round white spots; throat and belly dark leaden, the latter with ill-defined white spots; lower surface of limbs and tail, and præanal region pure white.

Total length	495	millim.
Head	35	„
Width of head	24	„
From end of snout to fore limb	49	„
„ „ „ vent	135	„
Fore limb	53	„
Hind limb	106	„
Tail	360	

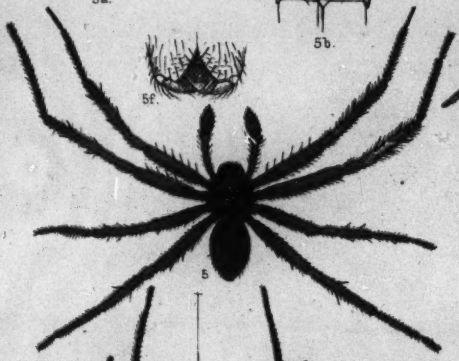
Two male specimens of this species were obtained by Mr. P. O. Simons near Guayaquil, in Ecuador. The fact of so large and conspicuous a Lizard having hitherto escaped zoological collectors in the vicinity of so well-explored a locality as the principal harbour of Ecuador is very remarkable.

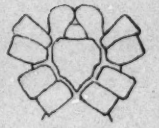
4. On some new Species of Exotic Araneidea. By the Rev. Octavius Pickard-Cambridge, M.A., F.R.S., C.M.Z.S., &c.

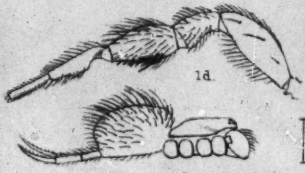
[Received April 6, 1899.]

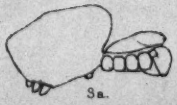
(Plates XXIX. & XXX.)

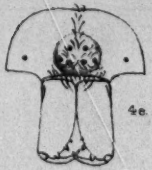
The twelve species of Araneidea described here belong to several families, and are from widely separated localities,—one species (each) from Bogota, Natal, and Madagascar, two from Singapore, and seven from Ceylon. Specimens of five of those from Ceylon were sent to me many years ago by the late Mr. G. H. K. Thwaites, of the Royal Botanic Gardens, and of two by Mr. Ernest E. Green, of Dickoya, Ceylon. The Singapore spiders were sent to me by Mr. H. N. Ridley, Superintendent of the Botanic Gardens. The Natal spider, an exceedingly fine and remarkable species of the genus *Poltys* C. Koch, was kindly given to me by Dr. F. N. Dimock Brown, together with some very characteristic coloured sketches











A T Hollick del. et lith.

West, Newman chr.

NEW SPECIES OF EXOTIC SPIDERS.

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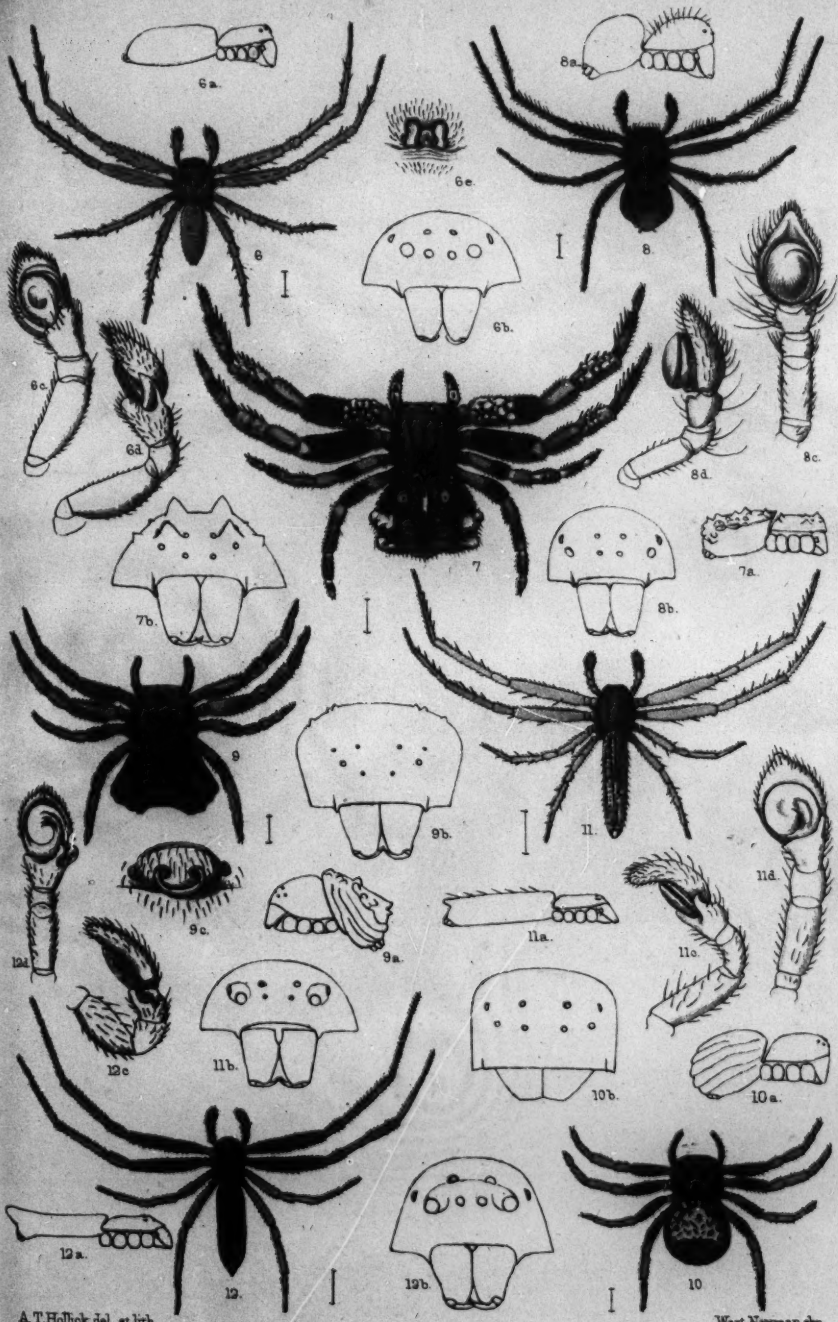

A. T. Hallock del. et lith.

West, Newman chr.

NEW SPECIES OF EXOTIC SPIDERS.

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of the spider when alive, drawn by Mrs. Dimock Brown. It is nearly allied to, but, I think, quite distinct from, *Poltys furcifer* Simon (a Zanzibar species). The drawings (figs. 4 *a*, 4 *b*, 4 *c*, Pl. XXIX.) represent this spider suspended by the terminal tarsal claws to its web, in a state of rest.

Fam. Theraphosidæ.

Evagrus pristinus, sp. n. (Plate XXIX. fig. 1.)

Adult male, length rather over 4 lines.

General form and structure normal.

Cephalothorax yellow-brown, with somewhat indistinct radiating stripes of a darker hue.

Falces similar in colour, their upperside furnished with a wedge-shaped area of strong prominent bristles, the point of the wedge directed backwards.

Legs also similar in colour, strong, moderate in length, 4–1–2–3. Tibiæ of the second pair very strong, rather prominent underneath, where the larger anterior half is furnished with 11–12 strong spines increasing in length backwards, the last three being disproportionately long and strong. The metatarsi of this pair are rather longer than the tarsi and are of a slightly sinuous form, with two somewhat obtusely conical diffused prominences, one on either side, underneath.

The *palpi* are of moderate length, and strong; the radial joint is about double the length of the cubital and much stronger, considerably convex and prominent on the upperside, and of a somewhat oval form, clothed with long bristles and hairs, some of the former, on the upper and under sides, being almost spines, and others in a denser group near the hinder extremity outside; the digital joint is short, broadest at its extremity which has a truncated appearance, with a largish obtuse lobe near the middle of the inner side. The palpal organs are of the ordinary simple Theraphosid form, consisting of a pyriform bulb, the anterior portion drawn out gradually into a long tapering spine ending in a fine hair-like point. The bulb is of a pale brownish-yellow colour, and along its inner side is a broad, curved, very distinctly defined yellow-brown band indicating the position of the seminal duct.

Labium broad, as broad as the fore extremity of the sternum, low, of a somewhat semicircular or crescent form, with a slight appearance of emargination at the apex, where there are a few short bristly hairs but no spines.

Abdomen subcylindrical, yellowish brown, pretty thickly clothed with long, somewhat golden-brown bristly hairs. Superior pair of spinners long, tapering, as long as (or even slightly longer than) the abdomen; the first and second joints are of equal length, the third, or terminal one, much the longest.

A single example received many years ago from Bogota.

Fam. Epeiridæ.

Milonia albula, sp. n. (Plate XXIX. fig. 2.)

Female, immature, length 2¼ lines.

Cephalothorax nearly twice as long as broad. Caput much developed, strongly convex and rounded at the fore part; oblique indentations between caput and thorax strong. Colour yellow-brown, caput darkest and tinged with reddish; some erect long bristly hairs in a longitudinal line at the hinder part of the caput.

Eyes subequal, in three groups, or two transverse curved rows, the convexity of the curves being directed forwards; the anterior row is much the more strongly curved; the four central eyes (or middle group) form a trapezoid, of which the posterior side is much shorter than the anterior, and its eyes near together, separated by less than half a diameter. The eyes of each lateral group are seated on a tubercle and near together, but not contiguous. The fore-central eyes are largest, and separated by rather over a diameter's interval. Clypeus almost obsolete.

Legs short, moderately strong, 1–2–4–3, the first three pairs nearly equal in length; spines very few and not strong; the third and fourth pairs apparently without any, the first two pairs have two on the inner side of the femora near the fore-extremity, and one or two on the inner side of the genual joints, and two or three on the tibiæ. Colour dull orange-yellow.

Palpi furnished with a few longish bristly hairs but no spines; the radial and digital joints dark brown, the rest paler.

Falces strong, straight, vertical, of a shining dark reddish-brown colour.

Maxillæ and *labium* of the normal Epeirid form; of a yellow-brown colour, paler at the extremities.

Sternum dark yellow-brown, truncated anteriorly, slightly drawn out into a fine point between the coxæ of the fourth pair of legs.

Abdomen cylindrical, rounded at each end, the spinners placed near the middle of the underside nearer to the fore than to the hinder end; it is of a dull whitish-brown colour, deepening into sooty anteriorly; the upperside is closely set with small cretaceous white spots forming a curved marginal band round the fore half, and a diffused longitudinal central band on which are six dusky brownish spots in two longitudinal parallel lines about the middle of the upperside.

Hab. Singapore. Received from Mr. H. N. Ridley, Superintendent of the Botanic Gardens at Singapore.

Gea lugens, sp. n. (Plate XXIX. fig. 3.)

Adult female, length 3 lines.

General form and structure normal.

Cephalothorax black or black-brown, clothed with adpressed grey hairs, those on the caput and margins of the thorax longest and densest.

Eyes unequal, the central quadrangle scarcely broader than long, the anterior side shorter than the posterior. The eyes of both the anterior and posterior rows appear to be about equally separated. The height of the retreating clypeus rather exceeds the diameter of the fore-central eyes. The fore-lateral eyes are much the smallest.

Legs neither long nor very strong, 1–2–3–4, furnished with hairs and a few fine spines; femora black, with a broad clear whitish-yellow annulus near their base; this annulus does not extend, in the first pair of legs, beyond the anterior part and sides; the rest of the legs is brown; the tibiæ semi-annulated with yellowish, the tarsi and metatarsi are palest, the hairs on the pale annuli are grey.

Palpi similar in colours and markings to the legs.

Falces powerful, vertical, roundly prominent at their base in front. Colour deep shining brown.

Maxillæ and *labium* deep brown, tipped with pale yellowish-white.

Sternum deep brown, with small eminences opposite to the insertion of the legs and clothed with adpressed grey hairs.

Abdomen oval, obtuse anteriorly, broadest in the middle, slightly prominent a little way above the spinners. Colour sooty-black, with a somewhat velvety look, marked on the upperside with yellowish-white oval and round spots of different sizes, forming a regular pattern; these spots are all clothed with silvery grey hairs; four form a square at the fore-side, followed by four other smaller ones, towards the spinners, the first two in a transverse line, and on each side of these are several others; on each side of the abdomen towards the spinners are some parallel irregular white lines, and in front of them, near the spiracular plates, is a rather large whitish-yellow patch. The underside is velvety black; at the middle on each side is a slightly curved longitudinal line of small white spots, and across the middle are two parallel white lines rather near to each other. Spinners short, compact, black-brown, and on each side of their base are two yellowish-white elongate spots. The genital aperture, in front of a small semicircular prominence, is rather inconspicuous but of characteristic form.

Hab. Singapore. Received from Mr. H. N. Ridley.

POLTYS BIMACULATUS, sp. n. (Plate XXIX. fig. 4.)

Adult female, length to posterior extremity 6 lines: height from extremity to summit of the abdominal elevation 10½ lines.

General form and structure normal.

Cephalothorax very gibbous both on the caput and thorax. Normal grooves and indentations very strong. Colour yellow, the oblique indentations at the junction of the caput and thorax are marked with a reddish line, and there is also a central longitudinal one from the occiput to the thoracic indentation. The prominence on which the central group of eyes is placed is furnished in front and around with strong grey and black bristles.

The *eyes* are small; those of the central quadrangle form nearly a square, the anterior side a little longer than the posterior; the fore-lateral eye on each side is equidistant from the fore and hind central eyes on its side; the hind-lateral eyes are far removed backwards from the fore-laterals; the fore-centrals appear to be a little the largest.

The *legs* are moderate in length and strength, 1–2–4–3, very little difference between 1 and 2. Colour yellowish brown, the femora of the first and second pairs bright orange-reddish; the tibiæ and metatarsi less bright, curved, furnished with spines; these are numerous as well as strong (though not very long), especially in front and on the inner sides of the tibiæ and metatarsi of the first and second pairs, the tarsi and the anterior portion of the metatarsi of which are suffused with dark brown. The hairs on the fore parts of the anterior tibiæ and metatarsi are coarse and grey.

Palpi similar to the legs in colour and armature.

Falces long, strong, pale brownish yellow.

Maxillæ, *labium*, and *sternum* pale yellow-brown, the last furnished with strong bristly hairs.

Abdomen large, the fore part (continuing the line of the hinder part in an even run) is greatly elevated, and a little tapering to a slightly enlarged part on the outer sides, rather in front of the top of which are six small prominences, three in a longitudinal line on each side; from this point there is a further but less strong production enlarging at its extremity which is bifid, being divided into two obtuse, rounded prominences. Colour yellow-brown, clothed with short grey and other hairs, and marked on the sides and hinder part with small black-brown spots, some forming on the sides obscure oblique lines; on the hinder part (looked at from behind) are two large, somewhat oblong or irregularly oval, deep rich bottle-greenish velvety markings in a longitudinal line; the hinder one of these markings is the largest, and both are narrowly edged with first a blackish, and then, outside (in the preserved specimen), a dull golden line.

This very remarkable Spider is nearly allied to a Zanzibar species, *P. furcifer* Sim.[1], but differs in the form and markings of the abdominal elevation. From a note received from its captor, it seems that this Spider has faded somewhat since it was placed in spirit, as he speaks of the "head, thorax, and adjacent sides of the legs being of an orange-red colour," and the bordering line of the green patches on the abdomen as pink.

Hab. Natal. Taken by Dr. F. N. Dimock Brown.

Fam. THOMISIDÆ.

RHITYMNA MORDAX, sp. n. (Plate XXIX. fig. 5.)

Adult male, length slightly over 4½ lines.

Cephalothorax as broad as long, the thoracic region almost

[1] Bull. Soc. Zool. de France, 1881, p. 4.

circular; the lateral marginal impressions at the caput rather strong, the anterior margin slightly curvitruncate; upper convexity moderate. Colour dull yellowish brown, paler on each side of the fore part of the thorax, and the ocular area is suffused with dark brown; it is clothed with coarse grey hairs, mixed with some long bristly reddish-brown ones on the caput.

Eyes occupying the whole width of the fore part of the caput, in two transverse curved rows, their convexity directed forwards; the anterior row is shortest but not greatly so and is rather more curved than the posterior. The fore-centrals are distinctly largest of the eight, and separated by rather less than a diameter; the fore-laterals are separated by about half that space from the fore-centrals; the former are on a strong tubercle. The eyes of the hinder row are about equally separated by nearly 2 diameters, they are about equal in size but much smaller than those of the anterior row. The central quadrangle is nearly a square, the fore-side being rather the longest. The hind-laterals are also seated on a strong tubercle. The height of the clypeus is about equal to the diameter of the fore-central eyes.

Legs long, moderately strong, 2–1–4–3; those of the second pair are only slightly longer than the first, and the third and fourth pairs much shorter than the first and second; they are armed with long, but not numerous spines; a tolerably dense scopula beneath the tarsi and metatarsi, and a compact claw-tuft beneath the terminal claws. The colour of the legs is yellow-brown, the metatarsi and tarsi much darker.

Palpi moderately long and similar to the legs in colour; on the upperside of the fore-extremity of the humeral joints are some short strong spines; the cubital is about half the length of the radial joint and somewhat clavate; these joints are furnished with long bristles, one or two being of a more spinous nature; at the fore-extremity on the outer side is a moderately long, stoutish and tapering, somewhat bent at its base, blackish-brown prominent apophysis whose extremity forms a short curved hook-like point; close behind and below this apophysis there is a dense tuft of longish, bent hairs. The digital joint is large, long and oval, more than double the length of the radial joint, dark yellow-brown, and clothed with coarse hairs. The palpal organs are compact but rather complex, and contained in an oval cavity near the middle of the joint; and among others a strong, curved, pale whitish corneous process or spine issues from near the middle on the inner side, and curving round by the inner margin of the joint terminates just beyond their extremity.

Falces powerful, prominent, gibbous and granulose in front, and with some strong teeth on each side of the fang-groove; colour deep black-brown, with strong prominent bristles in front.

Maxillæ short, broad, broadest at their extremity and slightly inclined towards the labium; on the inner side at their extremity is a dense group of divergent bristly hairs; colour deep brown.

Labium broader than high, its height rather less than half the

length of the maxillæ, and rather rounded at the apex; colour like that of the maxillæ.

Sternum as broad as or even a little broader than long, of a pale dull brownish-yellow colour, and somewhat triangular heart-shape; the posterior extremity is a little drawn out into an obtuse point.

Abdomen oval, of a dull luteous brown colour, paler above than on the sides, clothed with coarse pale hairs; spinners rather short, compact, the inferior pair much the strongest.

Hab. Madagascar.

DIÆA PLACATA, sp. n. (Plate XXX. fig. 6.)

Adult male, length $1\frac{1}{2}$ to $1\frac{3}{4}$ line. Adult female, $2\frac{1}{4}$ to $2\frac{3}{4}$ lines.

In general form and structure this species is normal, as also is the relative size and position of the eyes. The eyes, however, of the posterior row are less nearly equidistant from each other than in many other species, the central pair being considerably nearer together than to the laterals.

In the male the colour of the cephalothorax and falces is orange-yellow; the legs and palpi yellow, as also the maxillæ, labium, and sternum. The abdomen is of a dull luteous colour, marked along the sides with dull silvery white, and covered with a few dark bristly prominent hairs. Spines on all the legs excepting the tarsi. Claw-tuft small. Tarsal claws closely and regularly pectinate. Legs slender, relative length 2–1–4–3, 1 and 2 greatly the longest.

Palpi short, radial and cubital joints of equal length; the former has a few spiny bristles, and a long, pale, tapering and somewhat diaphanous curved spine-like apophysis at its fore extremity on the outer side, longer than the joint itself; on the underside is a much shorter and strong prominence somewhat bifid at its extremity, one of the bifid points being furnished with a terminal short thorn-like spine. The margin of the joint between these two apophyses has a row of short bristles which are continued round the edge of the lower apophysis. Digital joint rather small, short oval. The palpal organs consist of a strong circularly curved, tapering corneous process, surrounded by a black spine which emanates from the lower part on the inner side of the large process, and terminates on the outer side at its anterior extremity.

The female has the cephalothorax tinged more or less strongly with dull olive-greenish brown. The genital aperture consists of two small yellow-brown circular orifices in a transverse line, with the ordinary ducts and spermathecæ beneath the epidermis showing very distinctly in a somewhat omega-form.

It is very possible that this Spider when alive may be of a more or less vivid green hue like our native species *D. dorsata* Fabr.; colours of this kind usually fading in specimens preserved in spirit.

Adults of both sexes were received from Ceylon, from the late Mr. G. H. K. Thwaites.

PHRYNARACHNE FATALIS, sp. n. (Plate XXX. fig. 7.)

Female (not quite adult), length 2¼ lines.

Cephalothorax short, broad, nearly if not quite as broad as long, slightly roundly-truncate before; lateral marginal impressions at caput tolerably strong. Height of clypeus less than half that of the facial space. From the ocular area to the beginning of the hinder slope is a tolerably well-defined quadrate, somewhat elevated platform, which terminates at each corner in a strong conical prominence. There is also a strong tubercular eminence in the middle of each of the areas formed by the two groups of eyes (the two laterals and the fore and hind central eyes on each side). The sides of the cephalothorax are also covered with lesser tubercles of different sizes. The colour of the cephalothorax is yellow-brown, mixed on the clypeus, the sides, and hinder slope with deep brown.

The *eyes* do not differ greatly in size; they form a wider area than in the typical species. They are in two transverse curved lines whose convexity is directed forwards; the anterior line is much the shorter, and its curve a little stronger. The central quadrangle is broader than long, and its anterior side shorter than the posterior. The hind-central pair are smallest, and the fore-laterals largest of the eight. The hind-centrals are slightly farther apart than from the hind-laterals. The fore-centrals are about double as far apart as the fore-laterals.

Legs very robust, short, 2-1-4-3; 2 & 1 and 4 & 3 respectively not very different in length, the former longer and stronger; tuberculous, especially the fore part of the basal half of the femora; genuæ strongly angular; armed with spines, those of the metatarsi and tibiæ of the first two pairs much the stronger. Colour pale dull brownish yellow, blotched in parts with white and suffused with whitish; the anterior half of the first and second pairs black-brown. Tarsi end with a small thin claw-tuft. A strong spur in front of each of the femora, used probably, as in *P.* (*Ornithoscatoides*) *decipiens* Forbes-Cambr., for adhering (when on its back) to a leaf for capturing its prey.

Falces powerful, conical, broad and rather flattened in front; colour yellowish brown mottled with white.

Maxillæ and *labium* normal, deep brown in colour; the former pale at the extremities.

Sternum oval, broadly hollow-truncate before, and similar in colour to the maxillæ and labium.

Abdomen short, broad, roundly truncate at both ends, but much broader behind, rather flattened above; covered thickly above and along the sides with tubercles and conical prominences of various sizes; four of the largest of these latter, of a mottled yellowish-brown colour, form a large central quadrangle whose posterior side is shorter than the rest, the two foremost of the prominences being much the larger; both before and behind this quadrangle is another pair, nearer together, of much smaller, similarly coloured prominences; on each outer margin towards the hinder part is a con-

spicuous large prominence, white before, black behind, with others, smaller, both along the margin and side, before and behind it, and a row round the fore margin; there are also many much smaller tubercles over the surface, arranged somewhat symmetrically. The general colour of the abdomen above and on the sides is yellow-brown mixed with black-brown, black, and white; and between the anterior prominences of the central quadrangle is an elongate longitudinal white marking divided longitudinally by a dark-brown line, and on each side of its hinder end is a shining dark-brown tubercle. Spinners short, strong, very compact, and of a yellow-brown hue.

Hab. Ceylon. Received from the late Mr. G. H. K. Thwaites.

TALAUS OBLITUS, sp. n. (Plate XXX. fig. 8.)

Adult male, length slightly over $1\frac{1}{3}$ line (or nearly 3 mm.).

Cephalothorax a little longer than broad; somewhat subquadrate, the anterior side a little rounded, the posterior rather impressed and nearly as long as the anterior. Upper surface regularly convex, the normal grooves, indentations, and lateral impressions at the caput obsolete; height of clypeus less than half that of the facial space, and its profile follows the general slope of the fore part of the caput. The surface of the cephalothorax is covered, especially on the sides, with impressed spots or pock-marks, and with scattered, strong, erect spiny bristles issuing from transparent tubercles; these bristles, however, terminate in a curved transverse line at the upper part of the hinder slope. Its colour is a brightish yellow-brown.

Eyes in two very strongly curved lines, their convexity directed forwards (the posterior curve stronger) and occupying very nearly the whole width of the caput, or perhaps they may be more conveniently described as in three groups—a central quadrangle of four minute eyes broader than long, with its anterior side shorter; at a distance considerably greater than the space between the posterior eyes of the quadrangle and on each side of it, are two much larger eyes (the anterior the larger) in a slightly oblique longitudinal line, seated on a strong common prominence, and separated from each other by double the diameter of the posterior eye. The posterior eyes of the quadrangle with the anterior eyes of the lateral pairs form a very slightly curved line, the convexity of the curve directed backwards.

Legs moderately long, slender, 2–1–4–3, 2 and 1 much longer but not very different in length. They are furnished with long slender prominent bristles, a few of which are spiniform, and irregularly disposed. The femora are somewhat granulose or furnished with some minute tubercles; they have neither scopula nor terminal claw-tuft. The terminal claws are strong, those of the first and second pairs closely set with long pectinations, while the pectinations of those of the third and fourth pairs are short and fewer. The colour of the legs is similar to that of the cephalothorax.

Falces rather long, strong, conical, the anterior part somewhat

slightly flattened, but with a gibbosity at the base on the outer side; colour like that of the cephalothorax, and furnished in front with granulations; fangs short, base strong, the rest weak.

Palpi short; radial joint about equal in length to the cubital; at its fore extremity on the outer side is a strongish apophysis whose termination rather abruptly diverges outwards, and is tapering, apparently somewhat concave, and its point slightly obtuse or not very sharp; another apophysis on the underside is short, broad and obtuse. Digital joint of moderate size and broad-oval form. Palpal organs consist of a large, simple, prominent circular corneous lobe, forming a strong whorl with a long slender spine issuing from its posterior extremity and encircling the lobe round its inner and on to its outer side, in close contact with the margin of the digital joint. The colour and armature of the palpi are similar to those of the legs.

Maxillæ, *labium*, and *sternum* similar in colour to the cephalothorax; the two latter, however, are slightly suffused with blackish.

Abdomen short, broad, broadest behind, tolerably convex, furnished with short strongish spiny bristles on the upper margins, those above the spinners issuing from small tubercles. Colour yellow-brown, obscurely marked and suffused with blackish; on each side towards the hinder extremity are some obscure, roundish, dull yellow-brownish spots disposed in several oblique rows. Spinners short, inferior pair strongest. Anal tubercle strong and 2-jointed.

Hab. Ceylon. Received from the late Mr. G. H. K. Thwaites.

Boliscus decipiens, sp. n. (Plate XXX. fig. 9.)

Adult female, length 1¾ lines or 3·5 mm.

Cephalothorax as broad or broader than long, very convex and highest at the beginning of the hind slope, which is abrupt and steep; thence to the fore-margin of the clypeus the profile forms an even but not very strong curve. The height of the clypeus is less than half that of the facial space. Colour brownish yellow mottled with red-brown, darkest on the sides. The surface is covered with granulations and small tubercles; on each side of the hinder slope is a small but rather conspicuous group of 5–6 small conical white tubercles.

The *eyes* are small, and in two transverse curved lines forming a large crescent-shaped area similar to that of *Philodromus*. The anterior row is the shortest and its curve the strongest; the convexity of the curve is directed forwards; the lateral eyes are larger than the central, the fore-laterals largest, the hind-centrals smallest; these last are distinctly farther from each other than from the hind-laterals; the central quadrangle is broader than long, and its anterior side shortest; the eyes of the anterior row are more nearly equally separated, the fore-central pair being perhaps rather nearer to each other than to the fore-laterals.

Legs short, robust, 2–1–4–3, angulose; but little difference in length between those of 2–1 and 4–3 respectively, the last being

also not greatly shorter than the others; spines few and short, but there are numerous very short pale obtuse hairs. Colour yellow-brownish, mottled with red-brown and whitish; femora, except at the base beneath, dark reddish brown; beneath the tarsi and metatarsi is a kind of scopula of fine pale hairs, which extend over the extremity of the tarsi and form a sort of thin but extensive claw-tuft; the fore-sides of the femora are granulose.

Palpi short, robust; cubital joint subclavate and rather prominent in front; digital joint longer than the radial, of an elongate-oval form and rathered flattened; terminal claw very minute. Colour like that of the legs.

Falces conical, powerful; the profile continues the curve of the cephalothorax. Colour yellow, mottled with reddish yellow-brown.

Maxillæ moderately long, scarcely inclined to the labium, broader at their extremity, which is rounded on the outer side. Colour yellow, basal portion reddish brown.

Labium oblong, more than half the length of the maxillæ. Colour reddish yellow-brown.

Sternum rather small, oval, truncate before, blunt-pointed behind. Colour dark yellow-brown, paler in the middle.

Abdomen short, broad, broader than long, truncate before, where it fits up close to the whole width of the thorax, broadest behind; covered thickly with not very large tubercles and granulosities, the former subconical, and largest in the centre, along the outer margins, and behind. Colour yellow-brown mixed with brown and blackish of various shades, and a few small yellow-white irregular markings at the middle near the fore-margin and near the middle of the hinder margin. The sides and round the hinder part are strongly rugulose. Underside dark brownish, thickly clothed with prominent, pale, clavate hairs. Spinners short, very compact; colour yellow-brown. Genital aperture simple but of a characteristic form.

Hab. Ceylon. Received many years ago from the late Mr. G. H. K. Thwaites.

There is probably considerable variation in the distribution of colours in this species; in one example the upper and hinder parts of the abdomen are almost entirely pale dull yellowish; the hinder part with only a few small but distinct blackish spots.

HOLOPELUS PIGER, sp. n. (Plate XXX. fig. 10.)

Adult female, length nearly $1\frac{2}{3}$ lines.

Cephalothorax as long, or very nearly as long, as broad, subquadrate, with the corners rounded; lateral marginal impressions at the caput very slight. Upper convexity considerable, though the surface is somewhat flattened, and the sides vertical; slightly highest near the posterior slope, which is very steep and abrupt. Clypeus equal to, if not slightly greater than, half the height of the facial space, and following the slope of the ocular area in profile. Colour dark reddish yellow-brown, with a large diffused dull orange-yellow patch in the central line just before the posterior slope,

some indistinct lines of the same colour on the sides, and some similar patches round the fore part of the ocular area. The whole surface is granulose or pock-marked, and pretty thickly covered with short, stout, pale, somewhat squamiform hairs disposed in pretty regular lines; but there do not appear to be any of these hairs on the hinder slope.

Eyes in two transverse concentrically curved rows, occupying the whole width of the caput. The central quadrangle is much broader than long, and its fore-side slightly shorter than the hinder one. The interval between the central eyes of each row is much greater than that between them and the lateral eyes. The eyes of the lateral pairs are larger than the rest; the hind-centrals being the smallest.

Falces rather short, powerful, slightly tapering or subconical, of a deep reddish-brown colour, covered with hairs similar to those on the cephalothorax.

Legs short, not greatly differing in length, robust, 2–1–4–3. Spines almost entirely absent, one only beneath each of the tibiæ of the 1st and 2nd pairs. Colour rather pale yellow-brown, the femora suffused with a deeper brown. Tarsi of the first and second pairs of a somewhat elongate-oval form, terminating in a thin claw-tuft, but without scopula; tarsi of the two posterior pairs rather more of a slightly tapering form. Tarsi and metatarsi of equal length.

Palpi yellow-brown, short and strong; digital joint large, and of a somewhat flattened elongate-oval form.

Maxillæ and *labium* (much obscured by some foreign matter) apparently very similar to those of *Boliscus* Sim., and of a darkish yellow-brown colour.

Sternum longer than broad, oval, hollow-truncate before or heart-shaped.

Abdomen broader than long, nearly circular behind, a little flattened in front. Colour dull brownish, somewhat marked and marbled with whitish, especially on the anterior half; an irregular blackish marking occupies each side of the fore-margin, with a short whitish rim between them; and on the hinder part are some broken transverse brown lines or bars. The underside is pale brownish yellow with a diffused dark brown margin, and a large quadrate central patch of the same colour. Spinners short, compact, and enclosed or sunken within a marginal oval rim. Genital aperture small, but of characteristic form.

Hab. Ceylon, received from Mr. Ernest E. Green, to whom I am also indebted for other valuable spiders now in course of examination.

MONÆSES ATTENUATUS, sp. n. (Plate XXX. fig. 11.)

Adult male, length very nearly 3 lines.

Cephalothorax longer than broad, broadest at the caput just behind the eyes, narrowing a little and gradually to the hinder extremity, which is broad and a little rounded. Lateral marginal

impressions strong and abrupt, and very forward, being just in the line with the anterior row of eyes. Clypeus broad, sides parallel, very prominent and projecting, its anterior margin truncate, and its height (or width from front to back) exceeds half that of the facial space. Colour dull orange-yellow brown, bisected longitudinally by a white, somewhat broken line, and with other more or less distinct white lines converging to the thoracic indentation, which appears to be placed remarkably far back.

Eyes forming a broad curved area of uniform width; the anterior row shortest, the small central pair of eyes of this row smallest of the eight; all are seated on conical whitish tubercles, those of the lateral pairs much the largest and confluent. The eyes of the anterior row are equally separated; the hind-centrals a little farther from each other than from the hind-laterals. Lateral eyes much the largest. The curve of the two rows is not great, the convexity directed forwards. The central quadrangle is broader than long, and its fore-side shortest. The hind-lateral eyes are separated from each other by the width of the fore margin of the clypeus.

Falces strong, prominent, conical; similar in colour to the cephalothorax.

Legs long, moderately strong, 2–1–4–3, but little difference in length between 2 and 1. Spines normal, on all the joints excepting the tarsi; furnished also with numerous short, rather fine hairs, especially beneath the femora of the first and second pairs. Colour pale yellow-brown, more or less closely mottled or marbled with white, mostly so on the femora.

Palpi short, yellow; radial joint shorter than the cubital; at its extremity on the outer side is a not very long, strong apophysis, somewhat bifid and blackish at its extremity; underneath is another not so strong, rather longer, a little curved, tapering, and its obtuse extremity has a corneous appearance. Digital joint moderate in size, short-oval. Palpal organs simple, closely surrounded by a strong, tapering, black spine.

Maxillæ, *labium*, and *sternum* similar in colour to the legs, furnished sparingly with bristly hairs.

Abdomen long, narrow, almost cylindrical, very slightly tapering at its posterior extremity. Colour dull luteous, thickly marked with white distributed so as to give a somewhat linear, white, irregularly striped appearance; it is covered very thinly with small tubercles, from each of which as from a socket issues a prominent tapering, brownish, spine-like bristle. The hinder extremity is produced into a small kind of articulated tapering caudal prominence. Spinners short.

Hab. Ceylon. Received many years ago from the late Mr. G. H. K. Thwaites.

MONÆSES GREENI, sp. n. (Plate XXX. fig. 12.)

Adult male, length $2\frac{1}{3}$ to $2\frac{2}{3}$ lines.

Cephalothorax longer than broad, rather broadest at the caput; lateral marginal impressions at the caput tolerably strong. Clypeus

very prominent, almost on a level with the ocular area; its sides are parallel, its fore-side truncate, and its height very nearly equal to half that of the facial space. Colour deep bistre-brown, with a narrow cream-white margin and marked with longitudinal cream-white longitudinal lines; the two most distinct of these form lateral margins to the clypeus and ocular area, and are continued along the outer sides of the falces; two others, less distinct and curved, run backwards and enclose an oblong-oval space immediately behind the ocular area; two others also are near together on each side, parallel to each other and to the margins of the thorax, which last has also, in some examples, some very slender cream-white converging lines on each side of it.

Eyes in two almost or quite concentric, slightly curved transverse lines, the convexity of the curve directed forwards. The fore-laterals are considerably the largest, the fore-centrals smallest. The fore and aft width of the area formed by the eyes is rather less than half its transverse width. The central quadrangle is slightly less in length than in width (behind), but the anterior side is scarcely more than half the length of the posterior. The fore-central pairs are nearer together than to the fore-laterals, and those of the posterior row are equally separated or nearly so. The lateral eyes are all seated on strong prominences, especially the hind-laterals.

Legs long, slender, 2–1–4–3; those of the first and second pairs much the longest and not very different in length, nor is there much difference between the 3rd and 4th pairs. The colour of the first and second pairs is light yellow-brown, the fore-sides of the femora dark-brown; the third and fourth pairs pale yellow; spines few and inconspicuous; no scopula. Claw-tuft represented by a small group of bristles; terminal claws of the first two pairs moderately curved and strongly pectinated throughout, those of the third and fourth pairs less strongly pectinate.

Falces strong, prominent; profile following the line of the ocular area and clypeus, and strongly arched. Colour like that of the cephalothorax, and furnished with strong spine-like bristles in front.

Palpi short, strong; radial joint stronger than the cubital, with two or three spines in front and on the inner side, and at its fore extremity on the outer side is a strong apophysis, prominent, obtuse at its extremity, which is subdivided or somewhat bifid; digital joint rather large, elongate-oval. Palpal organs simple and encircled with one or two slender blackish filiform spines.

Maxillæ, *labium*, and *sternum* normal, and of a deep brown colour, the latter covered with strong prominent bristles.

Abdomen long, cylindrical, nearly 3 times the length of the cephalothorax; sides parallel, the anterior side hollow truncate, fitting up closely to the base of the thorax, and thinly covered with short spine-like bristles; hinder end tuberculose and drawn out into a pointed or conical, segmentate or articulate caudal form; each tubercle armed with a spine. Colour deep brown, approach-

ing black, mixed with yellowish brown; along each side is a very distinct cream-white marginal line, followed by others along the rugulose sides, parallel but finer and less distinct. The underside is deep brown. Probably a series of this Spider would show various differences in the proportionate length of the abdomen, as well as in the depth of its colour and in its markings. In one example examined the abdomen was black, the marginal white line on each side represented only by three slender linear white spots.

Three examples of this very distinct and striking species were sent to me from Ceylon by Mr. Ernest E. Green.

EXPLANATION OF THE PLATES.

Plate XXIX.

Fig. 1. *Evagrus pristinus*, sp. n., ♂, p. 519. 1 *a*, profile; 1 *b* and 1 *c*, palpus in two positions; 1 *d*, leg of second pair.

2. *Milonia albula*, sp. n., ♀, p. 520. 2 *a*, profile; 2 *b*, eyes and falces from in front.

3. *Gea lugens*, sp. n., ♀, p. 520. 3 *a*, profile; 3 *b*, eyes and falces from in front; 3 *c*, underside of abdomen; 3 *d*, genital process in profile.

4. *Poltys bimaculatus*, sp. n, ♀, p. 521. 4 *a*, profile; 4 *b*, view from behind; 4 *c*, view from in front (these three figures are drawn from Mrs. Dimock Brown's sketches of the living Spider suspended head downwards in its web); 4 *d*, profile of cephalothorax; 4 *e*, eyes and falces from in front.

5. *Rhitymna mordax*, sp. n., ♂, p. 522. 5 *a*, profile; 5 *b*, eyes from in front; 5 *c*, maxillæ, labium, and sternum; 5 *d* and 5 *e*, palpus in two positions; 5 *f*, lower extremity of falces from in front.

Plate XXX.

Fig. 6. *Dicæa placata*, sp. n., ♂, p. 524. 6 *a*, profile; 6 *b*, eyes and falces from in front; 6 *c* and 6 *d*, palpus in two positions; 6 *e*, genital aperture of ♀.

7. *Phrynarachne fatalis*, sp. n., ♀, p. 525. 7 *a*, profile; 7 *b*, eyes and falces from in front.

8. *Talaus oblitus*, sp. n., ♂, p. 526. 8 *a*, profile; 8 *b*, eyes and falces from in front; 8 *c* and 8 *d*, palpus in two positions (in figs. 8 *a* and 8 *b* the artist has unfortunately omitted any indication of the obscurely pock-marked and slightly tuberculose surface of the cephalothorax).

9. *Boliscus decipiens*, sp. n., ♀, p. 527. 9 *a*, profile; 9 *b*, eyes and falces from in front; 9 *c*, genital aperture.

10. *Holopelus piger*, sp. n., ♀, p. 528. 10 *a*, profile; 10 *b*, eyes and falces from in front.

11. *Monæses attenuatus*, sp. n., ♂, p. 529. 11 *a*, profile; 11 *b*, eyes and falces from in front; 11 *c* and 11 *d*, palpus in two positions.

12. *Monæses greeni*, sp. n., ♂, p. 530. 12 *a*, profile; 12 *b*, eyes and falces from in front; 12 *c* and 12 *d*, palpus in two positions.

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5. On the Species of *Canidæ* found on the Continent of Africa. By W. E. de Winton, F.Z.S.

[Received March 6, 1899.]

The acquisition by the Society of two living Jackals from Somaliland, of the species called by Prof. Noack *Canis hagenbecki*, hitherto unknown in a living state in this country, enforced the necessity of re-examining the African Dogs, and our Secretary has asked me to undertake the task. This communication is not confined to the Jackals of the Ethiopian Region, but takes in all the members of the family of Canidæ inhabiting the continent of Africa.

While endeavouring to throw some light into the hopeless confusion the nomenclature of the Jackals of Africa is now in, I do not expect the present communication to clear up all the disputable points; but it is hoped that by sifting the old descriptions and giving an account of the forms so far as are known to the principal Museums and Zoological Gardens of Europe, some better agreement as to which names shall be applied to certain forms may be arrived at. In no single museum is there to be found a good representative collection of the different African species, so that it is extremely hard to make comparisons and to recall exact characters of specimens examined in different museums. The type specimens of the older described forms have been in most cases mounted, therefore faded and worn almost beyond recognition, and the skulls inaccessible.

One species, *Canis lateralis*, described by Dr. Sclater in 1870, from West Africa, has since been generally considered to be identical with the *C. adustus* of Sundevall. So far as I can make out, the probability is that Sundevall had an example of *C. lateralis* before him, as it doubtless extends into S.E. Africa. But without examining the type it is impossible to be certain on this point, and I prefer to use the first name, of which there can be no doubt, as in this way no confusion can occur on the subject in the future.

Dr. Noack has lately published, from not at all satisfactory material, descriptions of four additional forms which I have little hesitation in assigning to one or other of the already well-known species. I am quite prepared, however, to find that this subject will soon require revision.

If, when we know more of the African Jackals, further subspecies are thought necessary, it will be quite evident, on looking at the synonymy given in this paper, that some of these names can be utilized, but so far I see very little use in subdividing the species.

I consider the Jackals and Foxes of the Old World so readily recognizable one from another that I should like to keep them apart, though no important character by which to distinguish them can be given. Even the outward characters and habits are beyond my power to define; and I regret to say that even Dr. Blanford's distinctions (Geol. & Zool. Abyss. p. 239) will not stand when

put to the test. A Jackal may have a sharp bark, as *C. adustus* (called "Quaha" by the Caffirs, from its cry), and the ears of a Jackal may be longer than those of the Common Fox, as in *C. variegatus* and *C. mesomelas*.

It is impossible to follow Gray (P. Z. S. 1868, pp. 492–525), who gave no anatomical or practical reasons for his arrangement and subdivision of the genus, but the Jackals and Foxes as they are usually classed form very natural and convenient groups or subgenera. The skull of a Fox is very much less powerful than that of a Jackal; the suborbital parts of the zygomata are more expanded and the inner surfaces of these bones are turned upwards. The small Foxes I shall group together under the name of Sand-Foxes, keeping the Fennec to form a separate subgroup by itself.

On looking at a number of skins of Dogs, one is struck with the constancy of the general pattern of the markings. Thus all the Jackals are inclined to a saddle-mark; this reaches perfection in *C. mesomelas*, while in *C. anthus* there is no defined line, though the fur is longer and thicker within the same limits. But the tendency to have a black spot on the dorsal surface of the tail, about two inches from the root, is a character which runs through the whole genus, Jackals and Foxes alike. This spot is no doubt due to a gland, for the hair of this region is more rigid than elsewhere, and there is no underfur growing upon it; the stiff hairs are generally shorter than those of the surrounding part of the tail and lie rather flat, forming a depression in the fur; and in many instances, in the dried skin, a yellow substance is found to clog the hair, which has a distinctly aromatic smell.

I have to record my best thanks to Dr. J. Anderson, F.R.S., Mr. R. J. Cuninghame, Major Harrison, D.S.O., and Mr. F. J. Jackson, C.B., who have helped me with specimens of Jackals, also to Colonel Lugard, C.B., for the loan of a specimen of the Hunting-Dog from British East Africa.

Genus 1. Canis.

Canis simensis. (Fig. 1.)

Canis simensis, Rüpp. Neue Wirbelth. Abyss. p. 39, pl. 14 (1838); Mivart, Canidæ, p. 18, plate, skull fig. 18.

Fig. 1.

Skull of *Canis simensis*, ⅓ nat. size. (B.M. 42.8.15.11; 162*a*.)

Canis sinus, Gerv. Hist. Nat. Mamm. ii. p. 58 (1855).
Canis walgie, Heugl. Nov. Act. Leop. 1863, Zool. Afr. p. 3.
Simenia simensis, Gray, P. Z. S. 1868, p. 506.
Canis semiensis, Heugl. Reise N.O.-Afr. ii. p. 48 (1877).

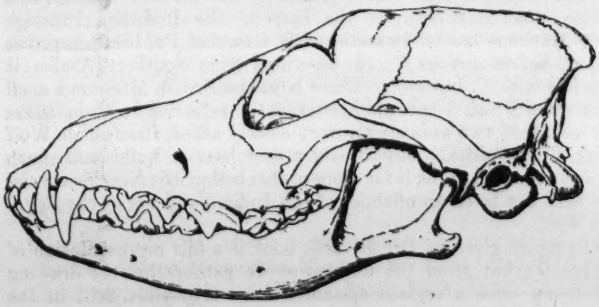
Very little is known of this somewhat isolated form of Dog, which seems to be confined to the mountainous district of Abyssinia. The specimen brought home by Rüppell, which is one of the types of the species, is still the only example in the British Museum.

The Jackals—*Sacalius*.

Canis anthus. (Fig. 2.)

? Le Chacal-Adive, Buffon, Hist. Nat. Suppl. iii. p. 112, pl. xvi. (1776).
? Barbary Dog, Pennant, Quad. i. p. 260 (1793).
? *Canis barbarus*, Shaw, Zool. i. p. 311 (1800).
Canis anthus, F. Cuv. Mamm. lith. pls. 173, 174 (1820); Mivart, Canidæ, p. 41, plate (partim) (1890), skull fig. 20.
Canis lupaster, Hemp. & Ehrenb. Symb. Phys., Mamm. ii. (1830).
Thous anthus, H. Smith, Jardine's Nat. Libr. ix. p. 195 (1839).
Thous senegalensis, H. Smith, Jardine's Nat. Libr. ix. p. 201 pl. xiii. (1839).
Sacalius barbarus, H. Smith, Jardine's Nat. Libr. ix. p. 218 (1839).
Canis aureus algirensis, Wagn. Schreb. Säug. Suppl. i. p. 384 (1841).
Canis aureus tripolitanus, id. ibid.
" " var. *algeriensis*, Less. Nouv. Tab. Règn. Anim. p. 43 (1842).
Lupus anthus, Gray, P. Z. S. 1868, p. 502.
Dieba anthus, Gray, Cat. Mamm. Brit. Mus. p. 189 (1869).
Canis aureus, auct. (partim), nec Linn.
Canis hadramauticus, Noack, Zool. Anz. 1896, p. 356 (fide Matschie).

Fig. 2.



Skull of *Canis anthus*, ½ nat. size. (B.M. 98.7.4.7.)

A larger animal than the Indian Jackal (*Canis aureus*), and

much more wolf-like. The nose and ears are bright bay, contrasting with the greyish forehead; there is no defined saddle, the black-tipped hairs appearing on almost all parts of the animal, but being scarcer on the flanks and legs; a blackish line runs down the front of the fore legs, ending in a distinct blotch on the wrist as in *C. lupus*. The tail is bushy, most of the hairs black-tipped, the black almost monopolizing the whole length of the hairs towards the end of the brush; the black spot over the gland is well marked, but owing to the general dark colouring is not particularly conspicuous. Ears moderate.

In Egypt this Jackal grows to a larger size—the skulls being equal to those of the Indian Wolf, *C. pallipes* Sykes nec Mivart; the colour is greyer than that of specimens from Barbary and the fur less rich. This form is generally called the Egyptian Wolf, but it will be seen by the specimens in the Society's Gardens that, when living in a moister climate, no difference can be detected in the colour or richness of the fur.

The North-African Jackal has never been given a very definite position as a species. All modern writers have either confused it with the Asiatic Jackal, *C. aureus*—a species which never crosses into Africa—or have only separated it with doubt; but there does not seem any valid excuse for uniting them. F. Cuvier was the first naturalist who gave anything like a scientific description of the animal. Pennant's "Barbary Jackal" does not seem quite satisfactory; this was a specimen found in the Ashmolean Museum at Oxford, a figure of which appears in Buffon's work, but I cannot fix this figure on any known Jackal. Shaw gave a Latin name to the animal described by Pennant, but it seems very doubtful whether this beast was a Jackal or a Fox. Uncertain names are simply placed in the synonymy, the earliest name of which there is no doubt being used.

This species ranges from Senegal on the west, round the whole of the north of Africa into Lower Egypt. Its exact range in the Nile Valley is not yet known, but so far no specimens have been recorded south of the First Cataract. So far as is known, this species does not occur to the east of the Red Sea; though Herr Matschie has lately stated (S.B. Ges. nat. Fr. 1897, v. p. 73) that *C. hadramauticus* Noack, described from Southern Arabia, is identical with *C. lupaster*. There is in the British Museum a skull from Aden which I have no hesitation in referring to *C. pallipes*; and as these two animals are very closely allied, the Indian Wolf being distinguished only by its rather heavier build and much stronger teeth, I think it far more probable that Dr. Noack's species will turn out to be an offshoot of the Indian, and not of the Egyptian Wolf.

The figure given in Dr. Mivart's book is a fair representation of the species, but from the letterpress we gather that the drawing was taken from a certain specimen from Abyssinia, still in the British Museum, which proves to be an example of the next species,

C. variegatus—the artist having probably worked up the picture with skins of the true *C. anthus* from Barbary.

The skull of the North-African Jackal is readily distinguishable from that of the Indian Jackal, *C. aureus*, by its greater size, and more particularly by the longer parallel-sided snout, and the high forehead more abruptly rising from the line of the nasals, the more evenly expanding—not bowed—zygomata, and the heavier dentition. But the larger Egyptian race very closely resembles the Indian Wolf, *C. pallipes* Sykes, the skulls of these two being practically the same size and shape, although the teeth of the Indian Wolf are much heavier. These different races therefore bridge over any marked distinction between the Wolves and Jackals.

Measurements (in millim.) of the upper flesh-tooth $\frac{\text{pm. 4}}{}$ are given of the smallest and largest of each species which has come under my notice :—

C. aureus.	*C. anthus.*	*C. pallipes.*
15·5–17	17·5–20	21–22

Dr. Mivart has caused much confusion by including *C. pallipes* in his description of *C. lupus*, the figure given of *C. lupus* var. *pallipes* being that of the form of the true Wolf found in Northern India.

C. pallipes, as described by Sykes, P. Z. S. 1831, p. 101, is particularly stated to be the Wolf of Deccan, so this name can only apply to the well-known Wolf of the Peninsula, which is not greatly superior in size to the Egyptian Wolf.

In Dr. Blanford's 'Fauna of British India' the two Indian species are fully and accurately described.

[P.S.—Since these notes were read I have seen specimens of Jackals said to come from Senegal and the interior of Tunisia, which seem to me to agree rather closely with Cuvier's description and figure of *Canis anthus*, and it is therefore possible that the large North-African Jackal which has been unanimously called *C. anthus* is bearing a wrong name, and should be called *C. lupaster*, while, of course, this much smaller, fine-legged, sharp-nosed, and paler-coloured animal is the true *C. anthus*. One specimen lately acquired from the Antwerp Zoological Gardens, and living in our Gardens in Regent's Park, is said to have been brought direct from Senegal; other specimens referred to are a male and female with cubs, beautifully set up as a group in the Leyden Museum. Dr. Jentink informs me that there can be no doubt as to the locality of these specimens, as they were collected in Tunisia by a well-known contributor to the museum.]

CANIS VARIEGATUS. (Fig. 3.)

Sea-Fox, Salt, Voy. Abyss. p. 172, App. iv. p. 40 (1814).
Canis variegatus, Cretzschm. Rüpp. Atlas, p. 31, pl. 10 (1826).
Canis riparius, Hempr. & Ehrenb. Symb. Phys., Mamm. ii. (1830).
? *Canis sacer*, id. ibid.

Thous variegatus, Smith (H.), Jardine's Nat. Libr. ix. p. 198, pl. xi. (1839).

Vulpes variegata, Gray, P. Z. S. 1868, p. 516.

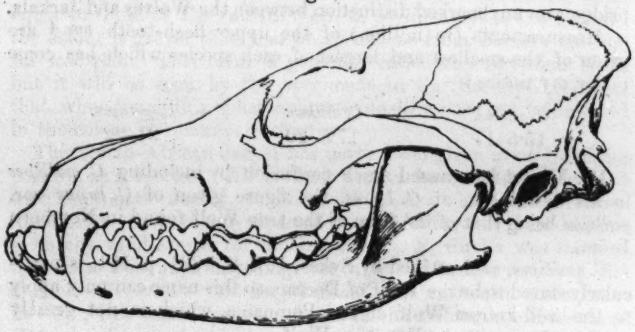
Canis anthus, Mivart, Canidæ, p. 41 (partim), plate inaccurate (1890).

Canis hagenbecki, Noack, Zool. Garten, 1894, p. 244.

Canis riparius Blanford, Geol. & Zool. Abyssinia, pp. 14, 240 (1870).

? *Canis mengesi*, Noack, Zool. Anz. no. 548, 1897, p. 518.

Fig. 3.



Skull of *Canis variegatus*, $\frac{1}{3}$ nat. size. (B.M. 169 *a*.)

General pattern of colour as in *C. anthus*, but very much paler; the snout very slightly more rufous than the rest of the face; the backs of the ears and the legs pale orange-red, but the latter mixed with some black, and a dark streak on the front of the wrist; on the back and sides there is more or less mottling of black; in some specimens the saddle-area is heavily mottled. On the whole of the saddle-area the fur is longer, reddish at the base, followed by a pale buff band and broad black tips; the freshness of this, in a more or less degree, accounts for the mottling. In some specimens from the highlands of Abyssinia it almost approaches the saddle of *C. mesomelas*, though the mixture of black on the flanks, the want of rufous colouring, and the strong dashes of black on the fore legs will at once distinguish it from that species.

Along the dorsal line, and especially over the shoulders, the hair is longer than on any other part. The black patch over the gland on the tail is conspicuous. The form is very gaunt (totally unlike any of its congeners), the snout is very fine and long, and the ears are remarkably long, which at once distinguish it from any specimen of the North-African Jackal.

The known range of this species is Upper Egypt and Sennaar, and along the coast from Suakim to Somaliland and the higher plateaux of Abyssinia.

This form, described by Cretzschmar and fairly figured from a specimen sent home by Rüppell, had doubt thrown upon it by the collector himself in his own work, Neue Wirbelth. Abyss., Säug. p. 39 (1838). At the same time we are told that the skull had been lost, and so comparison was not possible with that of *C. mesomelas*, of which species it was thought to be only a variety. Since that time no one but Dr. Blanford (Geol. & Zool. Abyss. p. 238) has given the species a proper status. The name has been used by some writers for the northern form of *C. mesomelas*; Dr. Mivart has confounded it with *C. anthus*. Dr. Noack has overlooked the species when naming the Somaliland Jackal *C. hagenbecki*; but since seeing examples of this latter form alive, and also having examined about a dozen skins and skulls, I feel no doubt in identifying the Somaliland animal with *C. variegatus*.

The form described by Dr. Noack as a separate species, under the name of *C. mengesi*, appears to me to be simply a sandy-rufous variety, wanting the broad black band in the fur of its back. The dark marks in the front of the fore legs are very much less distinct than in the typical form, but *are not entirely wanting*.

As mentioned above, the specimens from the highlands of Abyssinia, obtained by Dr. Blanford, are richer in colouring, and owing to the longer and *denser* fur would appear stouter in build (see *op. cit.* p. 240), but at the same time these specimens somewhat approach *C. mesomelas* in having heavier skulls; so it may be just possible that we have here a hybrid race confined to this high plateau.

Excepting in the narrowness of the frontal region and greater length of the facial portion, the skull of *C. variegatus* is very like that of *C. mesomelas*, only differing in its general narrowness and in the less expanded squamosal portion of the zygomata.

CANIS MESOMELAS. (Fig. 4.)

Canis mesomelas, Schreb. Säug. iii. p. 370, pl. 95 (1778); Mivart, Canidæ, p. 45, pl. (1890).

Canis variegatoides, Smith (A.), S. Afr. Quart. Journ. 1833, p. 85.

Thous mesomelas, Smith (H.), Jardine's Nat. Libr. ix. p. 199, pl. xii. (1839).

Vulpes mesomelas, Gray, P. Z. S. 1868, p. 516.

Canis variegatus, Matschie, Säug. Deutsch-O.-Afr. p. 64 (1895).

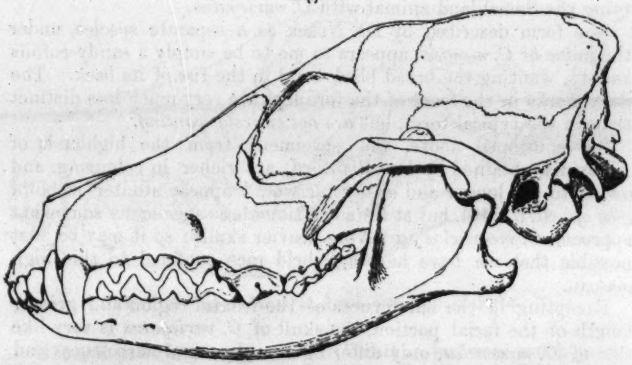
Canis mesomelas var. *schmidti*, Noack, Zool. Anz. no. 548, 1897, p. 519.

Face rufous, most of the hairs on the cheeks and forehead tipped with whitish; ears very large, bright rufous; saddle very distinct, all the hairs rufous at the base followed by a black ring, with a broad subterminal buff-white ring and tipped with black; the flanks and legs bright rufous without intermixture or markings of black. The tail is rather short, all the hairs tipped with black: the spot over the gland well developed; the stiff hairs are white for the greater part of their length, with jet-black tips. This is

the only Jackal which has no dark dashes on the front of the fore legs.

The Black-backed or Silver Jackal has the most extended range of any member of the genus inhabiting Africa, extending from the extreme south of Cape Colony to Abyssinia, and possibly Bongo-land, where Schweinfurth mentions Jackals with black backs ('Heart of Africa' (Engl. transl.) i. p. 237). It has not been recorded from the Mashonaland plateau or Nyasaland; and in British East Africa we have no record of it being found farther west than Machacos, where it occurs in company with *C. lateralis*. It seems therefore probable that this species does not range into the higher elevations.

Fig. 4.



Skull of *Canis mesomelas*, ⅓ nat. size. (B.M. 69.10.24.7.)

This species is therefore accompanied by *C. lateralis* in certain localities in the southern part of its range, and by *C. variegatus* in the northern. Specimens from south of the Zambesi, judged from the material in the British Museum, are rather larger, and the facial part of the skull appears slightly longer in proportion than those obtained from the north of that river; but whether the difference is sufficient to warrant a subspecies being made of the northern form is not clear, most of the specimens examined of the southern or typical form being deficient in the base of the skull. However, if a name is required for the northern form, Dr. Noack has provided one in his var. *schmidti*. In writing of this Jackal under the name *C. variegatus*, Herr Matschie mentions a stripe on the cheeks; but I cannot think his distinction of the East-African form is based on this character alone, for not only is it too trifling, but quite unreliable, as this dark line under the eyes occurs in some specimens from Cape Colony. The markings of this animal are not always equally well defined, occasional specimens have a very poorly marked saddle.

The cry of this animal, as observed in captivity, may be

expressed as "Wa-ah, wah, wah, wah," and when examining some suspicious-looking object it gives out a low growl ending in a suppressed bark.

The skull is short and strong, and the muzzle much broader than in *C. variegatus*; the squamosal portions of the zygomata are very much expanded; the nasal bones are short, being almost invariably shorter than the maxillary processes; there is a deep depression in the middle line of the very broad forehead; the carnassial teeth are very powerful and much larger than those of *C. lateralis*. *C. variegatus* seems to me to be the only Jackal of which the skull can possibly be confused with that of this species, but not only the muzzle but the skull throughout is much narrower in proportion to its length.

I give simple length and breadth measurements (in millim.) of the largest and smallest entire skulls of these two species that have come under my notice:—

C. variegatus.

Large ♂, from highlands of Abyssinia (Blanford), 172 × 90.

Small and quite young specimen from Nubia (Burton), 145 × 78.

C. mesomelas.

Adult from Ukamba, B. E. Afr. (Jackson), 151 × 88.

Young specimen from Ukamba (Harrison), 146 × 83.

CANIS LATERALIS. (Fig. 5.)

?*Canis adustus*, Sundev. Œfvers. K. Vet.-Ak. Förh. 1846, p. 121 (?); Mivart, Canidæ, p. 49, pl. (1890).

Vulpes adusta, Gray, P. Z. S. 1868, p. 515.

Canis lateralis, Sclat. P. Z. S. 1870, p. 279, pl. xxiii.

Canis holubi, Lorenz, Verh. Ges. Wien, 1895, p. 110.

? *Canis wunderlichi*, Noack, Zool. Anz. no. 548, 1897, p. 519.

Fig. 5.

Skull of *Canis lateralis*, ⅔ nat. size. (B.M. 92.12.3.8.)

General colour of the body-fur grey-drab, the majority of the hairs black-tipped, the face, ears, flanks, and legs being likewise heavily mixed with black, though the underfur of the face and legs

is more rufous than that of the body. Distinct dark dashes on the lower part of the forearm. On the dorsal surface, or saddle, the fur is bright rufous for the greater part of its length, each hair having a ring of black followed by a ring of buff and being tipped with black; these coloured rings form double side-stripes of buff and black bordering the lower edge of the saddle, which are often ill-defined or not observable, the colour of the flanks outwardly being scarcely different from the back, but when the hair is worn the saddle is often reddish. The tail is long and clothed with long hairs, buff at the base, and black for an inch and a half or so at their extremities; generally there is a distinct white tag, the hairs growing on the last two inches of the tail being sometimes pure white to their bases, in some specimens only a very few white hairs are to be found at the extreme tip. Tail-gland not conspicuous owing to the character of the surrounding fur. Chin black. Ears moderate.

Usually this Dog has the side-stripes, bordering the lower edge of the saddle, well defined; but when changing fur or when out of condition these stripes entirely disappear; this often happens in simply altering the lay of the fur in making up a skin. Possibly also in some districts the species does not develop these stripes to so great an extent as in others. At any rate it is probable that Sundevall had a specimen of this species before him when he described a Jackal from the Transvaal or Zululand, giving it the name of *C. adustus*. In this description, it is true, no mention is made of any side-stripes, but the Side-striped Jackal occurs in that country and *no Jackal without a saddle-mark is found anywhere in South Africa*. Dr. Noack seems also to have described the same animal as *C. wunderlichi*, but he appears to have entirely overlooked Sundevall's species as he makes no mention of it.

Dr. Sclater described *C. lateralis* from a specimen then living in the Society's Gardens, giving the side-stripes as the principal distinguishing characters and giving a name suggestive of this distinction. When this specimen died the skin and skull were acquired by the British Museum, and the skin, which is now before me, has no sign of side-stripes; the same thing has been shown in other examples which have been received from Nyasaland. Normally these latter are particularly well marked.

The skull of this species is readily distinguished from any other Jackal by its flatness, the line of the forehead running well in front of the orbits and being very little raised above the line of the nose. The nasals are long, extending beyond the maxillary bones; the squamosal portion of the zygomata is not so much expanded as in *C. mesomelas*; there is no depression in the middle line of the forehead; and the carnassial teeth are very much smaller than those of either *C. variegatus* or *C. mesomelas*.

In several specimens obtained by Mr. F. J. Jackson at the Ravine Station and Nandi, British East Africa, the skull is much arched, with smooth rounded forehead, quite altering the shape of the profile, but viewed from above the shape of the skull is unaltered. The flat and the rounded skulls are from animals otherwise identical,

and both forms were taken at the same time. These characters are found in both old and young, and it is most satisfactory to have such a fine series (about 20) taken in the same locality, proving that these characters are only individual and not racial. Mr. Jackson has noted measurements and weights of the majority of his specimens, and the total length to the end of the vertebræ of the tail ranges from 3 feet 3½ inches to 3 feet 5½ inches, the tail alone from 11½ inches to 12 inches. Weights of ♂ 14–16 lbs., ♀ 13½–15 lbs.

So far as is known the Side-striped Jackal ranges from Namaqualand [1] to the Gaboon on the west, and from Zululand to the Tana River on the east; it is found throughout Rhodesia, Nyasaland, and British East Africa as far west as Uganda.

This Jackal has several characters which bridge over the separating line one would like to draw between the Jackals and the Foxes: its tail is long, with a white tag; its cry is a short bark; and its skull is very flat, in side view very like that of the European Fox (*C. vulpes*); but no one can question its being a true Jackal.

Mr. F. C. Selous informs me that both the "Silver Jackal" (*C. mesomelas*) and the "Quaha" (*C. lateralis*)—easily recognized by their different voices—are found on the same ground in Bechuanaland, and that he has seen both of them come up from separate directions to a dead animal at the same time. These two forms are widely distinct, but it is nevertheless a very strange fact that two species should thrive in the same districts, seeing that their habits are alike; and considering their mode of life, it would seem certain that they must come to blows, and the weaker one succumb. These two animals live side by side in many districts up to the Tana River; northwards, in Somaliland, &c., *C. variegatus* takes the place of *C. lateralis*.

Mr. Selous further informs me that he has never seen Jackals in packs, that they come up singly or in couples from different hiding-places, whether to the camp at night or to a dead beast by day. He says, a favourite place for Jackals to lie up by day is in the long grass which grows on the sides of the ant-heaps, and that when hard pressed by dogs they often go to ground in the holes made by the Aard-vaark.

The Foxes—*Vulpes*.

(1) *Red Foxes*.

Canis vulpes ægyptiacus. (Fig. 6.)

Canis egyptius, Desmar. Nouv. Dict. Hist. Nat. xxiv. Tab. Méth. p. 18 (1804), *nom. nud.*

Canis ægyptiacus, Sonnini, Nouv. Dict. vi. p. 524 (1816).

Canis niloticus aut *ægyptiacus*, Desmar. Mamm. p. 204 (1820).

[1] Dr. Broom, of Garies, informs me the natives bring in skins of "Jackals with a yellow stripe on the side," together with those of the Silver Jackal, to trade with the store-keepers.

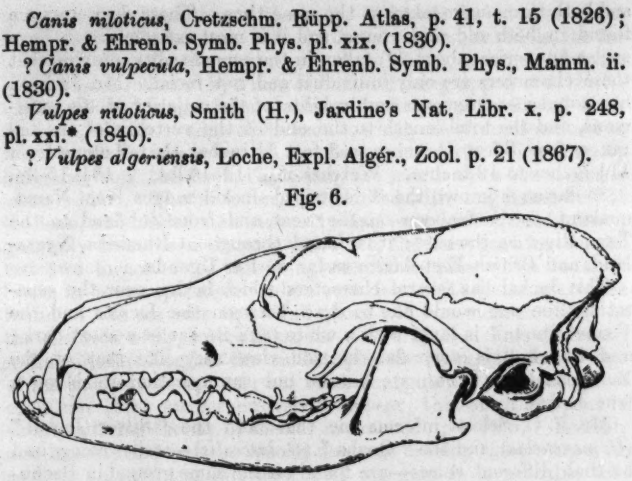
Canis niloticus, Cretzschm. Rüpp. Atlas, p. 41, t. 15 (1826); Hempr. & Ehrenb. Symb. Phys. pl. xix. (1830).

? *Canis vulpecula*, Hempr. & Ehrenb. Symb. Phys., Mamm. ii. (1830).

Vulpes niloticus, Smith (H.), Jardine's Nat. Libr. x. p. 248, pl. xxi.* (1840).

? *Vulpes algeriensis*, Loche, Expl. Algér., Zool. p. 21 (1867).

Fig. 6.



Skull of *Canis vulpes ægyptiacus*, ⅔ nat. size. (B.M. 98.6.5.6.)

This is a local race of the European Fox, *C. vulpes*, and may be barely separable from the S. European form (var. *melanogaster*).

The Algerian Fox is included in the synonymy, but this form seems identical with the Foxes of Southern Europe.

CANIS VULPES ATLANTICUS.

Canis vulpes, var. *atlantica*, Wagner (A.), Wagner (M.), Reis. in Algier, iii. p. 31, pl. 3 (1841).

Vulpes atlantica, de Wint. P. Z. S. 1897, p. 957.

This form of the Atlas Mountains is only another subspecies of the European Fox, rather smaller than the form found in Egypt.

(2) *The Sand-Foxes.*

CANIS PALLIDUS. (Fig. 7.)

? *Canis rüppelli*, Schinz, Cuv. Thierr. iv., Suppl. p. 508 (1825).

Canis pallidus, Cretzschm. Rüpp. Atlas, p. 33, pl. xi. (1826); Mivart, Canidæ, p. 142, pl., partim.

? *Canis sabbar*, Hempr. & Ehrenb. Symb. Phys., Mamm. ii. (1832).

Cynalopex pallidus, Smith (H.), Jardine's Nat. Libr. ix. p. 228, pl. xvii. (1839).

Canis corsac, Lesson, Tabl. Règ. Anim. p. 40 (1842), partim.

Vulpes pallidus, Gerrard, Cat. Bones Brit. Mus. p. 87 (1862).

Fennecus pallidus, Gray, P. Z. S. 1868, p. 520.

The dorsal region tawny, finely grizzled, almost the colour one sees in pale pug-dogs; paler on the sides and face, redder on the forehead; a reddish streak on the back of the fore legs from the

elbow downwards; reddish on the back of the thighs, above the tarsal joint. Most of the hairs of the tail are tipped with black, markedly so towards the extremity, the hairs at the end of the brush almost entirely black; there is a very distinct black patch on the tail over the gland. The fur is not so long or woolly and the tail is not so thick and bushy as in most small Foxes, and never has a white tag like *C. famelicus*.

Fig. 7.

Skull of *Canis pallidus*, ⅔ nat. size. (B.M. 93.6.7.3.)

The name given by Schinz to a small Fox brought from Dongola by Rüppell has generally been referred, with doubt, to *C. famelicus*; but I feel no hesitation in assigning it to the species under discussion. The description in no way agrees with *C. famelicus*, while the colour in every way fits this species: "Rücken und Schenkel von aussen gelbgrau; die Haare sind nehmlich brandgelb, mit Schwarz gemischt," &c. In fact, the tail, colour of the head, likeness to *C. zerda*, but with coarser fur, so exactly represent this animal, that I feel tempted to adopt this most appropriate term, seeing that it perpetuates the name of so good a naturalist; and whether we apply it to this form or to *C. famelicus*, we must deprive Cretzschmar of one original description. But as there is a doubt, and as Dr. Mivart has called *C. famelicus* by the unfortunate English name of Rüppell's Fennec, I shall leave it alone; my sole object in writing being to point out the most salient points of distinction between the species, and so to assist in arriving at a uniform naming, by which one may always know what form is intended when a certain name is mentioned.

The uniform tawny colouring, almost like a pale-coloured lioness, distinguishes this little Fox from all others, the black dash on the upperside of the tail and the black tip being the only conspicuous marks. The ears are about 65 millim. long.

The skull cannot be confused with that of any other Fox; the line of the forehead is carried forward considerably in front of the orbits, giving it the appearance of having a bump on the bridge of its nose; the teeth are very small and neat, the premolars with clear spaces between each; the flesh-teeth are actually smaller than those of the Fennec (*C. fennecus*), a much smaller animal.

Its range seems very restricted: all the specimens examined were obtained between Suakim and Dongola. Possibly the nearest ally to this little Fox is *C. bengalensis*, but this relationship is not close: it certainly has nothing in common with *C. corsac*.

CANIS FAMELICUS. (Fig. 8.)

Canis famelicus, Cretzschm. Rüpp. Atlas, p. 15, pl. v. (1826); Mivart, Canidæ, p. 144, pl.

? *Canis anubis*, Hempr. & Ehrenb. Symb. Phys., Mamm. ii. (1832).

Megalotis famelicus, Smith (H.), Jardine's Nat. Libr. ix. p. 235, pl. xx. (1839).

Fennecus famelicus, Lesson, Tab. Règ. Anim. p. 39 (1842).

Vulpes dorsalis, Gray, Cat. Mamm. Brit. Mus. p. 62 (1843), partim.

Fennecus dorsalis, Gray, P. Z. S. 1868, p. 519, partim.

Fig. 8.

Skull of *Canis famelicus*, ½ nat. size. (B.M. 98.6.5.7.)

Fur very long, soft, and dense; general colour soft fawn, more or less interspersed with coarser grizzled hairs, often giving it a steel-blue tint. Ears very long, rich fawn-colour: the face paler yellowish buff, with strong brown patches immediately above the whiskers, the dark colour, slightly modified, encircles the eyes. Along the dorsal line the fur is redder than on the sides, the underfur being grey tipped with reddish brown. There are reddish patches on the back of the hind legs above the heel. The tail is very thick and bushy along its whole length, with a very distinct white tag; there is a depression in the fur over the gland, and the hair is generally clogged at the base with a yellow substance, which gives off a distinct aromatic odour.

This is, perhaps, the prettiest of all the Sand-Foxes; the ears are very large, but not exaggerated like those of the Fennec. I am able to give the weight and dimensions of this little Fox, taken from fresh-killed animals by two collectors, to whom the Museum is much indebted for numerous carefully-collected specimens.

♀. Near Cairo, Mr. R. J. Cuninghame. Head and body 415 millim., tail 305, hind foot 97, ear 87; weight 2 lbs. 9 oz.

♀. Near Berbera, Dr. A. E. Atkinson. Head and body 445 millim., tail 345, hind foot 122, ear 100.

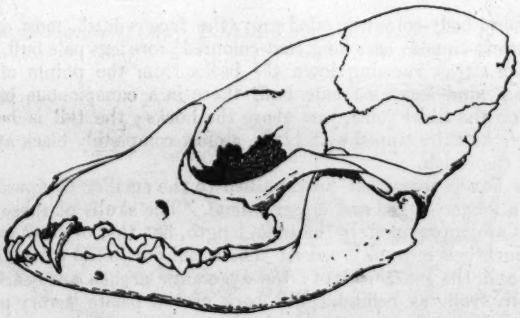
The skulls of other specimens from Egypt show that the specimen was rather undersized, but there is no difference worth mentioning between Egyptian and Somaliland specimens. A little Fox from Afghanistan, as mentioned and figured by Dr. Mivart, appears to be identical with this species.

The conspicuous brown marks on the face, the white tag to the tail, and the density of the fur are characters which could not possibly be excluded from any description; therefore I feel convinced that Schinz did not form his *C. rüppelli* on this species. The legs also are very short, and not longer in proportion than those of *C. zerda*.

CANIS DORSALIS. (Fig. 9.)

Canis (*Vulpes*) *dorsalis*, Gray, P. Z. S. 1837, p. 132.
Vulpes dorsalis, Gray, List Mamm. Brit. Mus. p. 62 (1843).
Fennecus dorsalis, Gray, P. Z. S. 1868, p. 519.
Vulpes edwardsi, Rochebr. Bull. Soc. Philom. Paris, 1882 (Oct.) p. 8.

Fig. 9.



Skull of *Canis dorsalis*, ½ nat. size. (B.M. 40.12.20.3.)

The type of Gray's species (from Senegal), which is still in the British Museum, is so much faded that it is impossible to give an accurate description of the skin; I can say, however, that it belongs neither to *C. famelicus* nor *C. pallidus*. The skull shows it to be a very young animal in milk-dentition, probably larger than *C. famelicus*, but its black-tipped tail proves that it is not even a local race of that species. Its much greater size is sufficient to separate it from *C. pallidus*. This is without doubt the same species as that described by Rochebrune. Dr. Mivart does not give an opinion on this species, and even leaves the name out of his synonymy.

CANIS CHAMA. (Fig. 10.)

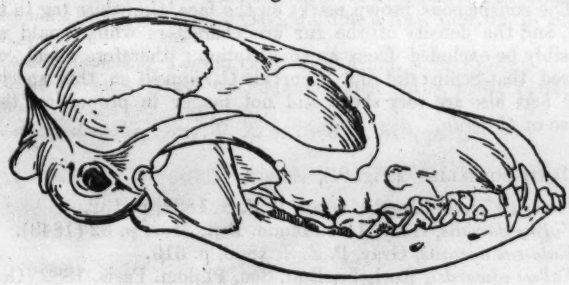
Canis chama, Smith (A.), S. Afr. Quart. Journ. 1833, p. 87; Sclater, P. Z. S. 1875, p. 81, pl. xvii.

Megalotis caama, Smith (H.), Jardine's Nat. Libr. ix. p. 236, pl. xix. (1839).

Vulpes caama, Gerrard, Cat. Bones Brit. Mus. p. 87 (1862).

Fennecus caama, Gray, P. Z. S. 1868, p. 520, fig. 7, skull.

Fig. 10.



Skull of *Canis chama*, $\frac{2}{3}$ nat. size. (B.M. 46.8.3.2; 815 *a*.)
(From P. Z. S. 1868, p. 520.)

General body-colour grizzled grey, the face reddish, most of the hairs white-tipped; ears long, rust-coloured; fore legs pale buff, with a brown streak running down the backs from the points of the elbows; hind legs also pale buff, there is a conspicuous brown patch on the tibial joint, just above the hocks; the tail is bushy, most of the hairs tipped with black, almost completely black at the end of the brush.

This Fox is somewhat nearly allied to the smaller *C. famelicus*, but is a longer-legged and larger animal. The skulls of these two species are approximately the same length, but that of *C. chama* is very much heavier and broader. The facial portion is particularly broad and the muzzle blunt; the zygomatic arches are nearly as broad in front as behind. The back of the palate is very much broader, the tooth-row actually shorter, and the teeth very small, measuring less than those of *C. famelicus*.

The skull much resembles that of *Otocyon*, but the squamosal portions of the zygomata are broader, and the supraorbital and temporal ridges are not so heavy.

This species is found in sandy districts south of the Zambesi, from the extreme south of the Colony to Namaqualand and Bechuanaland.

(3) THE FENNEC.

CANIS ZERDA. (Fig. 11.)

L'Animal anonyme, Buffon, Hist. Nat. Suppl. iii. p. 148, pl. xix. (1776).

"*Vulpes minimus saarensis*," Skjöldebrand, K. Sv. Vet.-Ak. Handl. 1777, p. 265, pl. vi.

Canis zerda, Zimm. Geogr. Gesch. ii. p. 247 (1780).

Canis cerdo, Gmel. Syst. Nat. i. p. 75 (1788).

Viverra aurita, Meyer (F. A. A.), Syst.-summ. zool. Entdeck. Neu-Holl. u. Afr. p. 91 (1793).

Fennecus arabicus, Desmar. Nouv. Dict. H. N. xxiv. 1804, Tabl. Méth. p. 18.

Megalotis cerda, Illig. Prodr. Syst. Mamm. p. 131 (1811).

Megalotis cerdo, Oken, Lehrb. Naturg. ii. p. 1032 (1816).

Fennecus brucei, Desmar. Enc. Méth., Mamm. p. 235 (1820).

Megalotis zerda, Schinz, Cuv. Thierr. i. p. 222 (1821).

Fennecus cerdo, Childr. & Vigors, Denham & Clapp. Trav. Afr. App. xxi. p. 183, pl. (1826).

Canis megalotis, Smith (H.), Griff. Cuv. Anim. Kingd. ii. p. 373, pl. (1827).

Megalotis brucei, id. ibid. v. p. 152.

Canis fennecus, Less. Man. Mamm. p. 168 (1827).

Megalotis zerda, Smith (H.), Jardine's Nat. Libr. ix. p. 237, pl. xx. (1839).

Fennecus zerda, Less. Nouv. Tabl. Règn. Anim. p. 39 (1842).

Vulpes zaarensis, Gray, List Mamm. Brit. Mus. p. 62 (1843).

Canis cerda, Gerv. Mamm. ii. p. 75 (1855).

Megalotis fennecus, Knight's Pict. Mus. Anim. Nat. p. 207 (c. 1860).

Fennecus zaarensis, Gray, P. Z. S. 1868, p. 519.

Fig. 11.

Skull of *Canis zerda*, ⅘ nat. size. (B.M. 182*f*.)

Very pale fawn on the upper parts, on the shoulders or fore part of the back some of the longer hairs are black-tipped; from the saddle backwards the hairs are more uniformly coloured and more glistening, paler on the face and legs, and gradually becoming silvery white underneath; brownish patches between the eyes and whiskers; black tip to the tail; gland on tail very evident, the coarse texture of the black-tipped hairs covering this part being more evident in this animal than in any other, owing to the silkiness of the fur generally. Underfur on all the upper

parts with a dark ash-grey band about equidistant between the base and the tip of the hairs; below this dark band the hair is silky white, above buff; on the underparts this dark band is not present. The hair exceedingly soft and silk-like.

Ears much longer than the head. In dry skins the ear measures about the same length as skull.

The skull is rather shorter than that of *C. pallidus*, but the breadth across the zygomata is greater; the nasal portion is very narrow; the orbits very large; and the front part of the brain-case considerably constricted. The length of the entire tooth-row is about equal to that of *C. pallidus*, the teeth being individually larger than in that species, and so set very much closer together.

There is very much uncertainty as to the distribution of this species; most of the known specimens have been brought from the Sahara through Algeria. Dr. Anderson will no doubt throw more light on it when the result of his researches into the mammalian fauna of the oases on the Egyptian side is made known.

Genus 2. Otocyon.

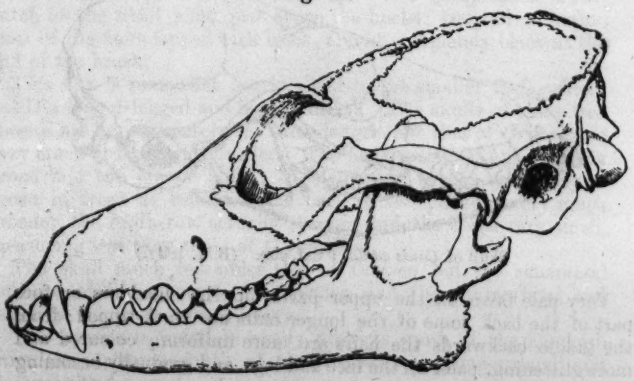
Otocyon megalotis. (Fig. 12.)

Canis megalotis, Desmar. Enc. Méth., Mamm. Suppl. p. 538 (1821).

Canis lalandi, Desmoul. Dict. Class. Hist. Nat. iv. p. 18, pl. (1823).

Megalotis lalandi, Smith (H.), Griff. Anim. Kingd. ii. p. 372, pl. (1827).

Fig. 12.



Skull of *Otocyon megalotis*, ½ nat. size. (B.M. 98.3.9.8.)

Otocyon caffer, Licht. Arch. f. Naturg. i. 1838, p. 290.

Agriodus auritus, Smith (H.), Jardine's Nat. Libr. x. p. 260, pl. xxiii.* (1840).

Otocyon megalotis, Lesson, Tabl. Règn. Anim. p. 39 (1842).
Otocyon lalandii, Gray, List Mamm. Brit. Mus. p. 62 (1843).
Megalotis lalandii, Gray, Cat. Mamm. Brit. Mus. p. 211 (1869).

General colour dark iron-grey, paler on the forehead and in front of ears; tips and back of ears, muzzle, fore and hind legs, dorsal surface, and tip of tail black. The fur of the back is very long. Everywhere the underfur is long, dark grey for the basal half and pale buff for the remaining half of its length; on the back the terminal half is more rust-coloured; the longer coarse fur is ringed with yellowish white, with long black tips. The ears are very large and rounded, of about the length of the head. The gland on the tail is well-marked and active.

The skull is very flat, with heavy supraorbital and temporal ridges; the orbit is more nearly encircled with bone than in any of the members of the genus *Canis*.

The teeth of this animal are quite unlike those of any true Fox. There is normally one more molar in each jaw than in the genus *Canis*, and the flesh-teeth both above and below are scarcely longer (in horizontal or vertical direction) than the teeth on either side of them.

This animal is found in sandy districts from the Cape to Somaliland. It has unfortunately been given the name of Fennec in South Africa, which has given rise to much confusion, since the true Fennec is not found in any part of its range and is a totally distinct animal.

Genus 3. Lycaon.

Lycaon pictus. (Fig. 13.)

"Mebbia," Kolbe, Kaap de Goede Hoop, i. p. 181 (1727).
"Chien Sauvage," Le Vaillant, Voy. 1er, t. i. p. 199 (1790).
"Wilde Hond" (Dutch), id. ibid. t. ii. p. 152 (1790).
Canis aureus, Thunb. Mém. Ac. Pétersb. iii. 1811, p. 302, nec Linn.
Hyæna picta, Temm. Ann. Gén. Sci. Phys. iii. 1820, p. 54.
Canis pictus, Desmar. Enc. Méth., Mamm. Suppl. p. 538 (1821).
Hyæna venatica, Burchell, Travels, i. p. 456, ii. p. 229 (1822).
Canis (*Lycaon*) *tricolor*, Brookes, Griff. Anim. Kingd. v. p. 151 (1827).
Lycaon tricolor, Brookes, Prodr. Anim. p. 10 (1828).
Cynhyæna, F. Cuv. Dict. lix. p. 454 (1829).
Canis hyænoides, Is. Geoff.?
Lycaon typicus, Smith, S. Afr. Quart. Journ. 1833, p. 91.
Lycaon pictus, Smith, ibid.; Mivart, Canidæ, p. 196 (1890).
Kynos pictus, Rüpp. Verzeichn. Mus. Senck. p. 19 (1842).
Cynhyæna picta, Lesson, Tabl. Règn. Anim. p. 38 (1842).
Lycaon venaticus, Gray, List Mamm. Brit. Mus. p. 62 (1843).

The peculiar colouring and habit of hunting of this animal are

too well known to need description; it is sufficient to say that no two skins are alike in pattern.

This species ranges in suitable localities from the extreme south of the Continent up the eastern side to Abyssinia; in the more central part of the Continent specimens of it from Lake Mweru have been obtained by Mr. Richard Crawshay, and Schweinfurth has recorded it from Bongoland.

Fig. 13.

Skull of *Lycaon pictus*, ½ nat. size. (B.M. 1141 *a*.)

I have particularly mentioned Le Vaillant's name in the synonymy, to draw attention to the work of that naturalist, whose observations on the habits and measurements of the mammals of South Africa are among the best and most accurate that have been published up to now. It has been the fashion to treat this traveller with disrespect; but his observations on mammals are excellent, and it is to be regretted that he did not carry out his promise of writing a special account of them.

May 2, 1899.

Prof. G. B. Howes, LL.D., F.R.S., F.Z.S., in the Chair.

Mr. Sclater exhibited specimens of some Mammals, mostly obtained by the collectors in the employment of the Administration of British Central Africa who accompanied the Commission for the Delimitation of the Anglo-German Boundary across the Nyasa-Tanganyika plateau in 1898. They had been kindly examined by Mr. W. E. de Winton, and referred to the following species:—

1. *Rhynchocyon reichardi* Reichenow.

Two specimens.

2. *Genetta tigrina* (Schreb.).

3. *Herpestes* sp. inc.
A flat native skin without skull obtained by Mr. J. B. Yule at Karonga, 13.7.98.

4. *Mellivora ratel* (Sparrm.).

5. *Sciurus cepapi* A. Smith.
Two specimens. Cf. *Tunisciurus cepapi*, Thomas, P. Z. S. 1897, p. 933.

6. *Procavia arborea* (A. Smith).
New to this locality, and only previously known from South Africa.

7. *Cephalophus lugens* Thomas, P. Z. S. 1898, p. 393.
The type of this species is of a uniform soot-colour. In the present specimen (which is marked male) the legs and a stripe on each side of the face are slightly reddish. The type was a female; so the difference in colour may be sexual.

Dr. C. I. Forsyth Major exhibited specimens of a Lemur from Madagascar, "*Prosimia rufipes*" of Gray, and made the following remarks:—

It is well known that the male of *Lemur macaco* L. is black, and that the female, which was at one time regarded as a distinct species (*L. leucomystax* Bartl.), is red. In 1880 the Secretary of this Society pointed out that a black Lemur, received at the Society's Gardens on Nov. 25th, 1878, and which was at first determined as *L. macaco*, proved to be distinct, and accordingly the name *L. nigerrimus* was proposed for the former, with the reservation that "it may possibly turn out to be a black variety of some known species." Figures are given of the heads of both species. *L. nigerrimus* is said to be "a larger and more intensely black animal, with a raised crest of short upstanding hair on its head. Moreover, the ear-conch is naked, and not furnished with tufts of hair as in *Lemur macaco*" [1].

At the meeting of this Society on February 28th, 1893, an extract from a letter from Prof. A. Milne-Edwards to the Secretary was read, in which it is stated that the female of *L. nigerrimus* is rufous-brown ("*brune*"), and that it had been described by Gray in 1871 under the name of *Prosimia rufipes*. Prof. Milne-Edwards further states that the colour of the eyes of *L. nigerrimus* and its female is characteristic, the iris being greenish blue ("*d'un bleu tirant sur le vert*"); also that the species comes from Cape Ambra, in the far north of Madagascar [2].

Gray's description of "*Prosimia rufipes*" was based on a male *and* a female specimen, which are exhibited in the Gallery of the Natural History Museum. Both are rufous-brown above, the

[1] P. Z. S. 1880, p. 451, figs. 1, 2.
[2] P. Z. S. 1893, pp. 177, 178.

only difference in the coloration between the sexes being that, whilst the underparts of the body are bright bay in the male, they are reddish-grey in the female [1]. The specimens were obtained by Crossley, and came, according to the Register, from the Betsimisaraka Country, which is rather a vague definition.

I have myself collected specimens of what I consider to be the same as Gray's species in four different forest-districts, from 900 to about 1300 metres above the sea-level, viz. at Ampitambè, N.E. Betsileo (at the confines of the Betsimisaraka country); at Ambohimitombo and Ivohimanitra, farther to the south, in the Tanala country (the Tanalas, "foresters," are part of the Betsimisaraka tribe); and, lastly, at Vinanitelo, Southern Betsileo, on the confines of the Tonalas of Ikongo. The coloration varies slightly from one locality to the other; especially the specimens from the lowest district, Ivohimanitra, are of a lighter coloration, and in the females the throat is white; in young specimens the whole of the underparts being of this coloration. From my material I am disposed to agree with Schlegel [2], who considered Gray's "*Prosimia rufipes*" to be the same as Is. Geoffroy's *Lemur rubriventer* and *L. flaviventer* [3], the latter based on the two female specimens held by Schlegel, rightly as I think, to be females of the former.

My collections contain about a dozen individuals, ♂, ♀, and young; but I have never met with a black male. At first sight it would appear quite possible that in the most northern parts of Madagascar the males of one species of *Lemur* might have a different coloration from those in more southern districts.

Unfortunately, neither the type of *L. nigerrimus*, which, as said before, lived at the Society's Gardens, nor any other black Lemur, apart from *L. macaco*, is in the Natural History Museum. I should not attach great weight to the colour of the iris, stated to be greenish-blue in both male and female *L. nigerrimus*, if this coloration were not such a very exceptional occurrence in Lemurs. All my supposed specimens of *L. rufipes* had a dark yellow iris, nor have I ever met with bluish eyes in any species of Lemur.

Of more importance still is the difference in the skulls, those of *L. nigerrimus* figured in Grandidier's work [4] being different from Gray's and my specimens of supposed *L. rufipes*. So that, in conclusion, until better evidence is forthcoming, I am not inclined to admit the specific identity of the two forms.

Mr. G. A. Boulenger exhibited a specimen of the fish *Polypterus congicus*, measuring 22 centimetres long, from the River Congo (Bangala Country), remarkable for the retention of the right opercular gill, the axis of which measured 34 millimetres and the

[1] Dr. J. E. Gray, "On a new Species of Lemur from Madagascar" &c., Ann. Nat. Hist. [4] vol. viii. p. 339 (1871); id. P. Z. S. 1872, pp. 852, 853, pl. lxix. (coloured figures inaccurate).

[2] H. Schlegel, Monographie des Singes, p. 311 (1876).

[3] Is. Geoffroy Saint-Hilaire, Catal. méth. Coll. Mammif. &c. pp. 71, 72 (1851).

[4] Hist. Madag., Mamm. Atlas, ii. 1890, pl.

fringes 15. The left opercular gill was absent, and nothing indicated its absence to be the result of an injury.

Mr. R. Lydekker, F.Z.S., exhibited a pale-coloured specimen of the Reed-buck (*Cervicapra arundinum*), and read the following notes on it, extracted from a letter addressed to him by Mr. Ewart S. Grogan:—

"I have much pleasure in forwarding to you the horns, head-skin, and hide of what appears to be a white Reed-buck. I shot the latter on the Longwe, at the north end of Lake Nyasa. Capt. Verhellen, of Mohun's expedition, first called my attention to it, by asking me (he knows nothing of the game in this part) what those little grey antelope were; he was *very* positive as to having seen four: one, a female, he wounded and lost; but though I hunted the small plain where he states he saw them, I never found any but the ram I killed, and it is the Reed-buck's habit to generally run in the same party; *i. e.* four running together would, I think, never go far apart, at any rate at the same season of the year. The natives whom I questioned closely say they have seen one only; but this counts for little. The buck showed no signs of albinism—lips, nostrils, *eyes*, and hoofs being of the normal colour. On comparing the skull with two others I thought I detected considerable variations, especially in the base of the skull. Will you kindly describe the animal for me, and bring it before the notice of those who are interested in this branch of zoology? Personally I am inclined, owing to the persistent rumours of similar animals in this country, the striking and *very* definite assertion of Capt. Verhellen, and the complete absence of the usual signs of albinism, to think that it is a distinct form. I have taken what measures I could to preserve the skin and trust that it will arrive in good order."

The following papers were read:—

1. On the Primitive Type of the Plexodont Molars of Mammals. By Florentio Ameghino, C.M.Z.S.

[Received February 13, 1899.]

The majority of placental Mammals, and especially the Ungulates, are distinguished by the plexodont character of their molars—that is, by molars having a complicated crown, and each tooth being provided with more than one root.

The origin of this dentition has been explained by two completely different theories—the theory of a gradual complication, and that of fusion. According to the former, the plexodont molars are the result of a progressive complication of the simple and conical primitive tooth of Reptilia. According to the latter, these same teeth are the result of fusion of the dental germs or embryos of

several simple teeth. It is this latter theory which I have been upholding for the last 15 years.

In a memoir published about three years ago[1], I showed that the tritubercular theory, contrary to what has been asserted, does not agree with the facts furnished by either the embryology, palæontology, or general morphology of the mammalian dentition. I observed, moreover, that triconodonty and trituberculy, far from being stages leading to the more complicated forms of teeth, are, on the contrary, the result of the reduction of the latter. It was not until after the publication of my paper that I learned that Dr. Forsyth Major had expressed views similar to mine in the Proceedings of this Society.

As a complement to my preceding work, I shall now endeavour to determine the most primitive type at present recognizable in the crown of the lower plexodont molars of Mammalia. In a subsequent paper I shall deal with the upper molars.

Firstly a few words on the terms used by me. I recognize in the dentition:—

(1) The deciduous molars (milk-teeth) and the persistent molars (true molars), representing together the *first series*, which is the oldest from an embryological as well as from a palæontological point of view.

(2) The replacing molars (premolars), representing the *second series*, which is of more recent date and always remains incomplete.

I assign to the teeth behind the canines the progressive numbers 1 to 7, since they are perfectly homologous in the Placentals and Marsupials, the only difference being that some teeth may belong to the first series in certain genera (*e. g.* the fourth of Marsupials) and to the second series in others (*e. g.* the fourth of Placentals).

Each of the lower complicated molars exhibits two lobes, an anterior and a posterior, and six cusps or denticles, three for each lobe. According to the authors of the tritubercular theory, these cusps have made their appearance gradually in successive geological periods, and they assign to each cusp a different name. These names have different suffixes in the molars of the two jaws; furthermore, there are different names for the same cusps in the premolars, for the lobes according to their form, for the colonnettes (styles) and crests (lophs), &c.; constituting altogether such a complicated terminology, that it remains absolutely unintelligible for all who have not specially studied the argument, and discourages many persons who wish to become initiated in the study of palæontology. Besides, these names correspond with conceptions which are often uncertain and sometimes preconceived.

I shall only make use of the old and vulgar names designating the different parts according to their position. Every complete plexodont molar has an anterior and a posterior lobe, each of them carrying three cusps. The three cusps of the anterior lobe are the median-anterior, the antero-external, and the antero-internal; the

[1] F. Ameghino, "Sur l'Évolution des Dents des Mammifères," in Bol. Acad. Nac. de Cienc., t. xiv. pp. 381–517 (1896).

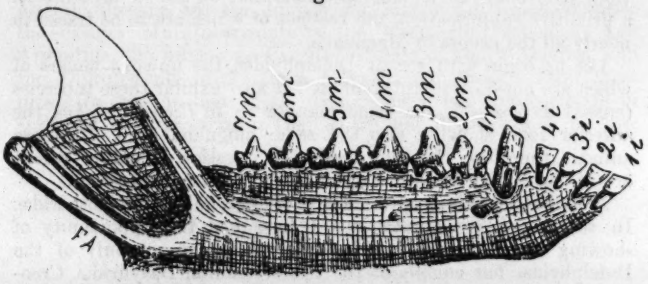
three cusps of the posterior lobe are the median-posterior, the postero-external, and the postero-internal.

According to the theory of gradual complication, the molars provided with these six cusps ought to belong to the most recent of Mammals. I shall show, however, that in all Mammalia, with the exception of the Monotremes, the Edentates, and the Cetaceans, the plexodont type is the most ancient and the starting-point of the different forms of complicated molars.

For the demonstration of the antiquity of this type, I shall avail myself of the numerous palæontological materials which the Cretaceous and Lower Tertiary deposits of Argentina have yielded.

The oldest fossil Mammalia of Argentina come from the variegated sandstones which in Patagonia underlie the Guaranian formation with gigantic Dinosaurians. The best-known genus, recently discovered, is the *Proteodidelphys præcursor*, the mandible of which, four times enlarged, is represented in fig. 1. *Eodidelphys*

Fig. 1.



Proteodidelphys præcursor: right mandibular ramus, outer aspect, four times nat. size.—Lower Cretaceous; Patagonia.

and *Microbiotherium*, of the Upper Cretaceous and Eocene, connect the former genus with the recent Didelphyidæ, so that *Proteodidelphys* represents the most ancient stem of this group; it has at the same time many affinities with *Paurodon* of Marsh, and other allied genera from the Upper Jurassic of North America.

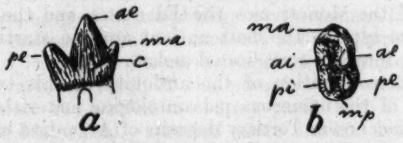
Fig. 2 represents the sixth lower molar, right side, of *Proteodidelphys*—*a*, outer view, *b*, upper view (magnif. 8 times). It may easily be seen that this tooth is composed of the two lobes and the six cusps before mentioned, which I designate by the following letters, the names in parentheses being those of Osborn's nomenclature.

ma, median-anterior (paraconid).
ae, antero-external (protoconid).
ai, antero-internal (metaconid).
pe, postero-external (hypoconid).
pi, postero-internal (entoconid).
mp, median-posterior [1] (hypoconulid).

[1] This cusp is generally diminutive and in the small forms to be seen only with the help of a strong lens. It loses its independence at an early date, by becoming fused either with cusp *pi* or with cusp *pe*, the latter occurrence being the more frequent.

On the outer side of the anterior lobe of the same tooth there can also be seen a small enamel ridge or *cingulum* (fig. 2 *a*, *c*), the presence of which must not be overlooked.

Fig. 2.



Proteodidelphys præcursor: sixth right lower molar, external (*a*) and superior (*b*) aspect, eight times nat. size.—Lower Cretaceous; Patagonia.

Finding thus in the teeth of such an old animal a complication which is said to be the result of a successive addition of cusps through geological ages, we have a right to doubt this latter assertion, and to assume as more probable that we are in presence of a primitive conformation, the vestiges of which are to be traced in nearly all the orders of Mammalia.

Let us begin with recent Didelphyidæ, the unworn molars of which are not only sextuberculate, but also exhibit these tubercles (cusps) disposed in the same manner as in *Proteodidelphys*, the anterior lobe showing also the same cingulum (*c*). In these animals, therefore, the complication in question is not of recent origin, but an inheritance of their oldest known predecessor.

Proteodidelphys is a representative of the family Microbiotheridæ. In several of my publications I have had the opportunity of showing that this family constitutes the stem not only of the Didelphyidæ but equally of the Sparassodonta, Dasyuridæ, Creodonta, Insectivora, and Carnivora. The lower molars of these different groups are merely modifications, generally not very considerable, of the molars of *Proteodidelphys*. In the Eocene Microbiotheridæ the modifications are insignificant. The molars of Cretaceous Sparassodonta still preserve the vestiges of all the cusps, which in their Eocene descendants are reduced by the disappearance of cusp *ai*, or its fusion with *ae*, followed by the atrophy of the posterior lobe and its corresponding cusps. The same is to be seen in the Australian Dasyuridæ, cusp *ai* being still present in *Dasyurus*, whilst it has disappeared in *Thylacinus*. The six cusps characteristic of Didelphyidæ are known to exist in most of the genera of Creodonta (*Palæonictis*, *Proviverra*, *Myacis*, &c.), the predecessors of the Carnivora; they equally persist in many of the latter, especially in Procyonidæ, recent (*Procyon*, *Nasua*) and fossil (*Cyonasua*), in primitive Canidæ (*Cynodon*) and Ursidæ, in the Viverridæ, &c. In some genera of Carnivora this form has scarcely undergone any appreciable modification: on examining the first inferior molar of *Cyonasua* (fig. 3), one is struck by its perfect resemblance to the corresponding tooth of *Proteodidelphys* and *Didelphys*. The same tooth-pattern is met

with again in many Insectivora (*Talpa*, Tupaidæ, Soricidæ, &c.), and likewise in the Chiroptera, especially in Vespertilionidæ, the most numerous and ancient family. In all these groups the molars differ from those of *Proteodidelphys* only by the greater or lesser development of cusp *ma*, by the suppression of cusp *ai* or its fusion with *ae*, and by the varying degree of simplification of the posterior lobe.

Fig. 3.

Cyonasua argentina: fifth right lower molar, superior (*a*) and external (*b*) aspect, nat. size.—Eocene; Patagonia.

Another branch, likewise originating from the most primitive Microbiotheridæ, are the diprotodont Marsupials, which comprise the extinct Multituberculata of the Northern Hemisphere and Argentina, the numerous Paucituberculata of South America, and the Diprotodonts of Australia (Hypsiprymnoïdea). Their most primitive type is that of the Garzonidæ. The lower molars of *Garzonia* or *Halmariphus* (fig. 4) are not distinguished by any

Fig. 4.

Halmariphus didelphoides: fifth right lower molar, superior (*a*) and external (*b*) aspect, eight times nat. size.—Eocene; Patagonia.

essential character from those of the Didelphyidæ; their teeth exhibit the six cusps of those of *Proteodidelphys*, with an almost similar disposition and with the same external cingulum, *c*. Some species depart slightly from this form by the internal displacement of the two median cusps, the anterior and the posterior, so that each molar presents on the internal margin a range of four cusps, as can be seen in the molars of a Cretaceous species of *Halmariphus*, or a nearly related genus (fig. 5). In the Epanorthidæ the paired cusps *ae*, *ai*, and *pe*, *pi*, are connected, forming two semicircular crests. In the Abderitidæ the same cusps constitute two feebly accentuated, transverse crests. The slightly more recent Diprotodonts of the Paraná deposits (*Zygolestes*) exhibit the same crests more accentuated; they are still more developed in the existing South-American genus *Cœnolestes* of O. Thomas, the molars of which have assumed the same form as those of the Australian

Diprotodonts. The latter are the descendants of the Diprotodonts which in former times inhabited Argentina. The multituberculate condition of the fossil Diprotodonts of the Northern Hemisphere is the outcome of the duplication of the molar cusps of the Paucituberculata. The Cretaceous and Eocene fossil forms of Argentina exhibit all the intermediate stages between the Multituberculata and the Paucituberculata; amongst these there is one, the *Mannodon*, in which the molars show a complication of exactly the same type as that presented by the classical molar of *Microlestes antiquus*, figured in all the manuals of palæontology.

Fig. 5.

Halmariphus guaraniticus: fifth right lower molar, superior (*a*), internal (*b*), and external (*c*) aspect, eight times nat. size.—Upper Cretaceous; Patagonia.

In the molars of the Cretaceous Rodents of Argentina the derivation from the sexcuspidate type is equally recognizable. The Caviidæ, with their molars formed of two triangular or cordiform prisms, and with an open cavity at the base, are those which depart most from the primitive form: it seems absolutely impossible to make out in these molars anything approaching those of the Didelphyidæ. However, the numerous fossil forms of this series graduate without interruption between the recent Caviidæ and the Eocene Eocardidæ, and between the latter and the Cretaceous Cephalomyidæ. Fig. 6 shows the seventh (ultimate)

Fig. 6.

Cephalomys prorsus: last right lower molar, superior aspect, eight times nat. size.—Upper Cretaceous; Patagonia.

right lower molar of *Cephalomys prorsus*, 8 times nat. size. In the two lobes of this tooth it is easy to recognize the two prisms of the Caviidæ; but the six elements corresponding to the six primitive cusps are likewise discernible, though disposed slightly differently from the ordinary. The three cusps of each lobe are disposed in a triangle, the two external, *ae*, *pe*, maintaining their position; but the two median, the anterior *ma* and posterior *mp*,

are limited to the internal margin. A somewhat similar disposition is seen in the molars of some Cretaceous Diprotodonts of the family Garzonidæ, *e. g.* the molar of *Halmariphus guaraniticus*, represented in fig. 5. This agreement in the disposition of the primitive molar elements seems to imply that the Rodents, the origin of which is still a mystery, may represent a side branch of the Diprotodonts, which originated towards the middle of the Cretaceous period.

We may next consider the Ungulates, which by their molars, at least those of the present epoch, do not appear to bear any relation to the Didelphyidæ and their predecessors. This, however, is not the case. In a recent publication, I have declared that in the Cretaceous of Argentina all the groups of Ungulates exhibit in the form of their molars a great resemblance to each other: all show the sexcuspidate form; if not visible in the adult, it is seen in young stages.

The Argentine Proterotheridæ, resembling the Horses in their tridactyle and even monodactyle hoofs, and the Palæotheridæ in their molars, are amongst the most characteristic and most specialized of Ungulata. Their oldest known representative is the *Deuterotherium distichum* of the Upper Cretaceous; its fifth right lower molar, just in the beginning of wear, is represented from the upper aspect in fig 7*a*. This tooth shows the six conical and

Fig. 7.

Deuterotherium distichum: fifth right lower molar, twice nat. size.—Upper Cretaceous; Patagonia. *a*, Superior aspect of tooth which has just pierced the gum; *b*, superior aspect of worn tooth of adult; *c*, external aspect of slightly worn tooth.

perfectly separated cusps, with a disposition closely similar to that of *Proteodidelphys*, and also with the *cingulum* (*c*) on the external side, visible in figure 7*c*, which represents a slightly worn specimen of the same tooth. However, in the present genus this conformation had become transitory, as shown by the figure, 7*b*, which exhibits the crown view of the same tooth in a worn condition; the positions formerly occupied by the primitive elements are marked by the corresponding letters, but the cusps are no longer recognizable, and without being acquainted with the unworn tooth it could not be guessed that its starting point is almost absolutely identical with the form presented by the same tooth of the Didelphyidæ and of *Proteodidelphys*. The last-named

figure (7 *b*) demonstrates the origin of the similar characteristic molars in a considerable number of Ungulates—*e. g.*, the Proterotheridæ, Macrauchenidæ, Meniscotheridæ, Rhinoceridæ, Titanotheridæ, Palæotheridæ, &c.; as well as in the long series of ruminant and selenodont Ungulata. In the ancient Pleurasapidotheridæ of France the form of the inferior molars of *Proteodidelphys* is preserved almost without any change.

The characteristic molar pattern of omnivorous Ungulata is the result of the atrophy of the median-anterior cusp *ma* and the median-posterior *mp*, or of their being intercalated in the same transverse line between the internal and external cusps of each lobe, *ae*, *ai*, and *pe*, *pi*. The lophodont pattern of the Tapir's molar is the result of the atrophy of the median-anterior cusp *ma* and of the union of the external cusps *ae*, *pe* with the corresponding internal *ai*, *pi*, by means of transverse crests. The origin of the molars of Pyrotheridæ is the same, with the only difference that the median-posterior cusp *mp* is lengthened in a transverse direction, so as to form a sort of transverse heel (*talon*). The passage from the dentition of *Pyrotherium* to that of *Dinotherium*, and from this latter to that of *Mastodon* and of *Elephas*, is easily recognizable.

In other Ungulata the median-posterior cusp *mp* became fused with the postero-external *pe*, in order to form a large external curved or crescentoid lobe, whilst the postero-internal *pi* approached the antero-internal *ai*; so that the two median cusps *ma*, *mp* became separated by three notches on the internal margin. The Horses (Equidæ) are in this condition, as well as good number of Isotemnidæ, the Homalodontotheridæ, Leontinidæ, and Tillodonts. The oldest known predecessor of the Horse series is *Morphippus* of the Upper Cretaceous. Fig. 8 shows its fifth right lower

Fig. 8.

Morphippus imbricatus: fifth right lower molar, slightly worn, superior aspect, twice nat. size.—Upper Cretaceous; Patagonia.

molar of a young individual, the six cusps being distinctly visible and partly independent. The successive changes leading to the Equidæ are indicated by the same tooth of *Morphippus* in a worn condition (fig. 9), and by the corresponding tooth of the Upper Eocene *Notohippus*, represented in fig. 10 *b*, side by side with that of a recent Horse (fig. 10 *a*), so that the same elements with the identical fundamental disposition can be seen in them.

The hypselodont molars with open cavity at the base, of several Ungulates, *e.g.* the Toxodontia and Typotheria, show the greatest departure from the primitive type by the complete fusion of their elements; however, by means of their oldest predecessors, they can be traced to the same origin. The slightly worn molars of

Fig. 9.

Morphippus imbricatus: fifth right lower molar of adult, superior aspect, nat. size.—Upper Cretaceous; Patagonia.

Fig. 10.

Notohippus toxodontoides: fifth right lower molar, superior aspect, twice nat. size.—Upper Eocene; Patagonia. *a*. Crown of homologous tooth of existing *Equus caballus*.

the Cretaceous Toxodonts (*Proadinotherium*, *Pronesodon*) are completely similar to those of *Morphippus*; so that it becomes almost impossible to distinguish isolated molars of animals of the series terminating with the Equidæ from those belonging to animals of the Toxodont line.

Fig. 11.

Archæophilus patrius: fifth right lower molar, unworn (*a*) and worn (*b*), superior aspect, four times nat. size.—Upper Cretaceous; Patagonia.

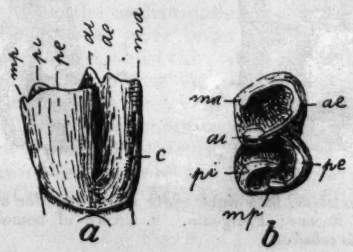
The teeth of Typotheria are a little different. Fig. 11 *a* repre-

sents the unworn fifth right lower molar of *Archæophilus patrius*, from the Upper Cretaceous; the six cusps are perfectly distinguishable, although very low and disposed a little differently. The cusp *mp*, which is very large and completely separated from cusp *pe*, has moved to the internal side, and these cusps disappear without leaving any trace as soon as the teeth begin to be functional; so that the molar acquires an entirely different contour and appearance, as shown by fig. 11 *b*, representing the same tooth of an adult specimen.

In the unworn lower molars of *Prosotherium*, another Cretaceous genus of the same order, the cusps *ma* and *mp* are placed towards the outer side, so that the six cusps are disposed in two longitudinal series separated by a deep longitudinal furrow. The cusps *ae* and *ai* being also higher and thicker than the others, the crown assumes a certain resemblance to that of the molar of *Microlestes antiquus*, a very remarkable and suggestive fact.

The origin of the molars of Primates is the same. Here, too, as in the bunodont Ungulata, the mound-shaped, bulky, and thick cusps, characteristic of the omnivorous condition, are a recent and gradual acquisition.

Fig. 12.



Notopithecus fossulatus: fifth right lower molar, slightly worn, external (*a*) and superior (*b*) aspect, four times nat. size.—Upper Cretaceous; Patagonia.

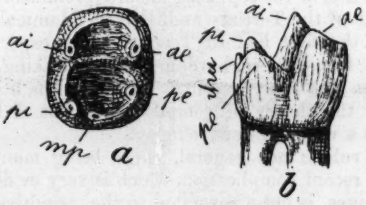
Fig. 13.

Pitheculus australis: fifth right lower molar, superior (*a*) and external (*b*) aspect, four times nat. size.—Upper Eocene; Patagonia.

Fig. 12, *a*, *b*, exhibits the fifth lower molar, not much worn, of *Notopithecus fossulatus*, from the Upper Cretaceous, external view and upper view. This tooth shows distinctly, although not

much accentuated, the six primitive cusps, as also a trace of the cingulum, *c*; the chief difference from *Proteodidelphys* being seen in cusp *ma*, which has moved to the inner side. Fig. 13 represents the same molar of the Eocene genus *Pitheculus*, a Monkey of the family Homunculidæ. This tooth is more square and has lost the indentation on the internal side of each lobe; the cusps are more in the shape of mounds, while the median anterior cusp is very small, forming part of an anterior crest, from which it is scarcely distinct. In *Homunculus*, of the Upper Eocene, the same tooth (fig. 14) shows the median-anterior cusp *ma* to have become effaced

Fig. 14.



Homunculus patagonicus: fifth right lower molar, superior (*a*) and external (*b*) aspect, four times nat. size.—Upper Eocene; Patagonia.

by fusion with the anterior crest, whilst the tubercular or bunodont form is more pronounced. In recent Monkeys and in Man the transverse anterior crest, the last vestige of cusp *ma*, has also disappeared, there remaining only the four cusps *ae*, *ai*, *pe*, *pi*, which are in the form of mounds or tubercles almost equal in size and imparting to the crown the perfect omnivorous aspect. The cusp *mp* often remains visible, generally placed between the two posterior cusps *pe* and *pi*, but always of minute size.

At different times I have supported the contention that the complicated molars of Mammalia have retained the same form from one end of the series to the other, with no other change than that of the relative size of their different parts. On this hypothesis, the simplification of the deciduous molars and of the premolars must be considered as a secondarily acquired character, due to the want of space for the complete development of these teeth—a simplification which must have been acquired progressively from before backwards.

I have insisted on the fact that the deciduous molars, although remaining in function for a short time, are almost always more complicated than those which replace them. This is in agreement with the theory of fusion and primitive complication, since the deciduous teeth are the older dentition of the two; but it is in contradiction to the theory of gradual complication. I have also drawn attention to the fact, almost universal in Placentals

that the last deciduous molar more closely resembles the first true molar than the last premolar. Recently I wished to make sure if this fact could also be observed in Marsupials; and I am able to state that in several small species of *Didelphys* the unique deciduous molar—which corresponds with the third deciduous molar of Placentals—does not at all resemble the premolar by which it is replaced, but exhibits the form of the fourth persistent tooth (true molar), which in Marsupials is homologous with the fourth deciduous molar of Placentals, *i.e.*, belongs to the first series. These facts prove conclusively that the deciduous molars had originally the same form as the persistent (true) molars.

We next come to the question of the degree of complication of the deciduous and of the replacing molars (premolars). On looking over the whole of the Tertiary and Recent Mammals, we observe that those of the first half of Tertiary times, especially those of the Northern Hemisphere, have, generally speaking, more simple premolars than the more recent. This fact has been considered as a proof of the theory of complication; but I hold that the explanation is a very different one.

Firstly, the rule is not general, there being many exceptions. Secondly, this recent complication, which is very evident in several phylogenetic lines, is but a reversion to the primitive complicated type. Of this I proceed to give proofs.

The mandible of *Proteodidelphys*, seen from the external side (fig. 1), shows the three anterior molars of the simple form as in the Recent and Tertiary *Didelphys*. However, in examining these same teeth of *Proteodidelphys* from the inner side, the vestiges of a complication comparable to that of the posterior molars may be seen, a complication which in this genus seems to be on its way to disappear. Fig. 15 shows the third right lower molar, seen from

Fig. 15.

Proteodidelphys præcursor: third right lower molar, external (*a*) and internal (*b*) aspect, eight times nat. size.—Lower Cretaceous; Patagonia.

the outer side (*a*), which is simple, and from the inner side (*b*), which shows the rudimentary traces of the cusps of the posterior molars; these same rudiments are visible, although successively less accentuated, on the anterior molars, the second and the first. The molars of Didelphyidæ exhibit no traces of this complication, neither are they to be seen in the Microbiotheridæ of the Eocene and the Upper Cretaceous. Now, since it is evident that the Didelphyidæ are the descendants of the Microbiotheridæ and that

the oldest known representative of the latter is *Proteodidelphys*, we conclude that originally the anterior molars were composed of

Fig. 16.

Homunculus patagonicus; second to sixth lower molars, superior aspect, four times nat. size.—Upper Eocene; Patagonia.

the same elements as the posterior. These elements were already almost suppressed in the *Proteodidelphys* of the beginning of the Cretaceous, and had completely disappeared in the molars of the Eocene Microbiotheridæ, which in this respect resemble the recent Didelphyidæ.

The traces of the vanished elements are only visible on the inner side, because the teeth in question are inserted obliquely, as shown by the figures 1 and 15, which represent them, together with the anterior root, from the outer side, the posterior one being scarcely visible. On the inner side the inverse takes place, viz., the posterior root occupies almost the whole of the internal face, while the anterior root is almost invisible. As these anterior molars, which are more simple but bear the traces of a vanished complication, are in an uninterrupted, closely arranged series with the posterior molars, the idea arises, quite naturally, that the oblique insertion is the outcome of the want of space for their development, so that the cause of the simplification of the elements on the postero-internal side would be the oblique insertion as a consequence of the want of space. The oblique insertion, but not the complication, is still discernible in the Eocene

Microbiotheridæ, but no traces of it are to be seen in recent Didelphyidæ, although the molars have again assumed their original longitudinal disposition.

These observations can be confirmed by the examination of all the old groups of Mammalia. Not wishing to pass all of them in review, I limit myself to the Primates, the great antiquity of which had not been guessed before their discovery.

The genus *Homunculus* of the Patagonian Eocene—a true Monkey with rather specialized characters—is particularly interesting. Its lower premolars, seen from the outer side, exhibit a single convex lobe as in the Cebidæ, and totally different from the persistent (true) molars, which bear two well-developed lobes. Nevertheless, on examining these same premolars from the inner side or from above, they present a completely different appearance. These teeth are seen to be inserted obliquely or almost transversely, so that they show on the outer side only the enlarged anterior lobe with the three well-developed primitive cusps; whereas the posterior lobe has moved inside and is partly atrophied, showing only the postero-internal cusp *pi*, and the postero-external *pe*, which has moved inside and with which the median posterior cusp has become fused.

In the line of the Primates the anterior molars have therefore also possessed the same form as the posterior ones, their secondary and recent simplification being due to the want of the space necessary for their development. The premolars, in consequence of being pressed together, have assumed an oblique position, partly overlapping one another, and producing the atrophy of the posterior lobe, which is no longer visible in the same teeth of more recent Monkeys and of Man. In the Primates this atrophy began during the Cretaceous, since it is already to be seen in the Notopithecidæ, all the members of which exhibit the same oblique insertion of the anterior molars. I have also found it in several lines of Ungulates, especially in the Protypotheridæ, the Isotemnidæ, the Astrapotheridæ, &c. I draw the conclusion that the plexodont molars of Mammals, the anterior as well as the posterior, had originally the same degree of complication, and that the simplification of the anterior molars, observable in numerous Mammals of the latest Cretaceous and of the beginning of the Tertiary, is a secondarily acquired character. This simplification was the outcome of a concentration of the dental series, by want of the necessary space for their development[1].

The diminution of the space assigned to the development of the

[1] To those desirous of becoming acquainted with a similar instance in a mammal of the Northern Hemisphere, I will point out one which at this moment comes under my notice. I have just received Prof. Osborn's memoir on the "Evolution of Amblypoda, Part I.," in Bull. Amer. Mus. of Nat. Hist. xi. 1898; and on page 172 I find the figure of the mandible of *Pantolambda cavirictus*. A glance at this figure shows that in this ancient genus the premolars are inserted obliquely, the posterior lobe being turned inwards and atrophied in the same manner as in *Proteodidelphys*, *Protypotherium*, *Homunculus*, &c.

premolars seems to bear a relation to the greater or lesser retardation in the development of some teeth belonging to the same series. In a considerable number of cases the immediate cause of the simplification of certain molars is simply to be found in the accelerated or retarded development of neighbouring teeth. When the molars find the place unoccupied, they preserve their form or even may become more complicated. Those teeth which at the moment of piercing the gum find the place anterior to them occupied, extend posteriorly, and *vice versa*, or they become reduced if the place is occupied on their anterior as well as on their posterior side.

It is well known that in the majority of modern Placentals, as also in those belonging to the most recent geological periods, the adult dentition is composed of teeth belonging to two different series. The posterior, persistent teeth belong to the first series, of which the deciduous teeth also form part; while that anterior portion of the dentition which is represented by the premolars belongs to the second series, the posterior part of which, that corresponding to the persistent (true) molars, is not developed. The molars of the first series are accordingly not all in function at the same time, being developed in a very unequal manner; when the last persistent teeth come out, the anterior teeth of the same series have already been replaced by those of the second series.

The same was not the case formerly. Ancient Mammals, *e. g.* the Nesodontidæ, Adiantidæ, Homalodontotheridæ, Notohippidæ, &c., had, during part of their life, all the deciduous teeth (the anterior part of the first series) in function at the same time as all the persistent teeth; in other words, the complete first series was in function at the same time. In these families the deciduous molars, as well as the premolars, were well developed and always exhibited the same form from one end of the series to the other, so that the molars of the second series, replacing the deciduous teeth, occupied the same space and reached the same size. Later on, however, as a consequence of the accelerated development, by which the deciduous molars came to be shed before the animal was adult, whilst the persistent molars remained in function, these latter acquired a greater development and encroached on part of the space left free by the deciduous teeth. As to the premolars, finding the space between the canine and the first persistent molar greatly reduced, they were pressed together and had to assume an oblique position, the posterior lobe being turned towards the inner side. This oblique position of the teeth, together with the want of space necessary for their complete development, caused the reduction of their interior side and especially of the posterior lobe, which in many genera disappeared completely [1].

[1] All that has been stated with regard to the lower premolars applies equally also to the upper premolars, in which the atrophied lobe is the posterior, especially its inner portion.

These changes were brought about during the Cretaceous and the early portion of the Tertiary period. In the later Tertiary a change in the opposite direction took place, viz., a progressive retardation in the evolution and the development of the persistent molars; so that the moment arrived when all the deciduous teeth were in function, without any of the persistent teeth having made their appearance. Finding the place free, the deciduous molars were able to assume a greater development, the last of them advancing gradually backwards, thus increasing the space for the replacing molars, and diminishing in the same proportion the space destined for the persistent (true) molars. As a consequence of this reduction of space, these latter have become proportionally smaller, and in the end cut the gums successively one after the other, sometimes at rather long intervals. For the opposite reason, viz. as a consequence of an increase of space, the replacing molars increased in size; this enlargement was accompanied by a gradual complication, giving to the molars a uniform appearance from one end of the series to the other, just as during the Cretaceous. The complication of the anterior molars is therefore a reversion to a primitive form.

To sum up. As a result of the comparison of the palæontological materials with those furnished by recent Mammals, it can be stated that, in the same proportion as the duration in function of the deciduous molars decreases, the space assigned to the replacing molars also decreases; and in the same proportion as the development of the persistent molars is retarded, the space occupied by the deciduous molars and the premolars is increased.

This discovery explains a number of facts which have hitherto remained almost incomprehensible. I shall confine myself to a few examples which are easily understood.

The third lobe of the last lower molar of Ungulates represents the median posterior cusp *mp*, which was enabled to assume this greater development because there are no other teeth behind to prevent it. In the other molars this cusp is, on the contrary, obliged to maintain its median position between the posterior cusps *pe* and *pi*, which are fused together. For the same reason the posterior lobe is to be seen also in the last deciduous lower molar of recent Ungulates, since in the latter this tooth remains for a long time in function, before the first persistent tooth makes its appearance. As a consequence, in these Mammals the last deciduous molar differs both from the one by which it is replaced (the fourth premolar), and from the first persistent molar, resembling the last persistent molar. In the primitive Ungulates, on the contrary, which had all the teeth of the first series in function at the same time, the last deciduous molar could not extend posteriorly, its cusp *mp* being prevented by the next following molar; and therefore the tooth in question (the last deciduous molar) is different from the last persistent and resembles the first persistent and the fourth replacing molar.

On examining the mandible of a young sheep having the three

deciduous molars in function, and before the first persistent molar has appeared, it can be seen that the last deciduous tooth, having more than the necessary space for its development, is strongly inclined posteriorly, so that it diminishes the space which will have to be occupied by the persistent molars, and increases in the same proportion the space assigned to the replacing molars.

This inequality in the development of the molars also explains why the last upper replacing molar of Ruminants and Artiodactyla generally is notably smaller and simpler, not only than the one on its posterior end, but also than the one anterior to it. This fourth replacing molar is the last to cut the gum, and must adapt itself to the space left free by the penultimate replacing and the first persistent tooth.

Lastly, I have to observe that the sexcuspidate form of tooth, which is represented as the last term of evolution of molars, is very frequent in the oldest Tertiary Mammalia of Europe, and especially in those of the Cernaysian Fauna. To judge from the figures of the recent publication by Mr. Matthew on the Mammalian Fauna of the Puerco, a great number of Mammals of this epoch also have sexcuspidate inferior molars. Going a step backwards, we can perceive, with the help of Osborn's and Marsh's publications, that almost all the Mammals of the Upper Cretaceous of North America are provided with sexcuspidate or even more complicated (multituberculate) molars. Going another step backwards, the figures published by Marsh enable us to recognize the same type amongst several Jurassic genera, *Peralestes*, *Peraspalax*, *Paurodon*, *Laodon*, *Dryolestes*, &c., which show their posterior molars resembling those of Didelphyidæ and of *Proteodidelphys*. Going still farther backwards, we find the oldest known fragments belonging undoubtedly to a mammal, *Microlestes antiquus*, with plexodont molars not far removed from those of *Proteodidelphys*, and with a crown more closely resembling the crown of unworn deciduous molars of certain primitive Ungulates (*Prosotherium*, *Prohegetotherium*, &c.) than the molars of the Plagiaulacidæ (*Plagiaulax*, *Neoplagiaulax*, &c.).

I do not maintain that the first complicated molars were sexcuspidate, rather than quadri- or quinque-cuspidate. On this point I have sufficiently explained my opinion in my memoir "Sur l'Évolution des Dents des Mammifères." The clear result of all these facts is, that the famous theory of the gradual complication, of triconodonty and trituberculy, is an untenable hypothesis. Nowhere do we meet with the stages leading from haplodonty to plexodonty; all those which have been mentioned are, on the contrary, as I believe I have demonstrated, but the result of simplification of molars which were formerly more complicated. Plexodonty therefore presents itself as a primitive character, having made its appearance suddenly; and it is only the theory of fusion which can explain it in a satisfactory manner.

2. On Chinese Mammals, principally from Western Sechuen. By W. E. de Winton, F.Z.S. With Notes on Chinese Squirrels. By F. W. Styan, F.Z.S.

[Received March 14, 1899.]

(Plates XXXI. & XXXII.)

In 'The Ibis' of April for this year (1899, p. 289) will be found, in a paper on "Birds from West China," a condensed account of a collecting-trip made by two native collectors employed by Mr. F. W. Styan, F.Z.S. The mammals obtained on this trip have been put into my hands for description; Mr. Styan having himself written the part on the Squirrels, after looking over the specimens from that country in the Paris Museum.

The British Museum is much indebted to Mr. Styan for many interesting specimens in different branches of natural history, and I have now to record the gift of a fine series of Chinese Squirrels.

Other small mammals collected in China in well-known localities, such as have been mentioned in recently published accounts, are not referred to in this paper.

Western Sechuen has been visited by very few collectors, and the fauna is principally known from collections brought home by Père David, and more recently by Berezowski; but it will be seen that these two collectors did not exhaust the store of peculiar local forms. The localities mentioned will be more easily traced by referring to Mr. Styan's own paper in 'The Ibis.'

Rhinopithecus roxellanæ. (Plate XXXI.)

Semnopithecus roxellanæ, M.-Edw. C. R. Acad. Sci. 1870, t. lxx. p. 341.

Rhinopithecus roxellanæ, M.-Edw. Rech. Mamm. p. 253, pls. 36, 37 (1874).

♂, ♀. Yang-liu-pa, N.W. Sechuen.

The female agrees fairly well with the figures given by M. Milne-Edwards. The chief differences are that the whole forehead is uniformly coloured bright orange; there are no light patches over the eyes; the ears are covered with cream-coloured hair; the front of the face beneath the eyes is clothed with the same orange-coloured hair as the rest of the face, so that only the nose and the rings round the eyes are naked; the upper lip has a few projecting white hairs. The hands are pale yellow, the dark colour ending on the forearm.

The male (figured, Plate XXXI.), which is a very aged animal, differs principally from the female in the brighter and more rufous tint in the colour of its fur. The face is not so well clothed with fur, the hair beneath the eyes being scant and adpressed and not

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RHINOPITHECUS ROXELLANÆ.

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LEPUS SECHUENENSIS.

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bushy as in the female. The cheeks, throat, and sides of the head and neck are bright red-rust colour; the crown of the head and nape are rich red-brown, instead of being nearly black. The inner sides of the limbs, and upper sides of the hands and feet are much more richly coloured orange or bright golden red. The hairs on all parts are very lustrous.

The measurements of the skull of this old animal are very much larger than those given by M. Milne-Edwards: the breadth of the face outside the orbit is 90 millim., the greatest expansion of the zygomata 100; while the breadth of the constriction behind the eyes is 51, as in the younger specimen. The base of the skull has been cut away, so that it is not possible to give very full measurements.

RHINOLOPHUS ROUXI.

Rhinolophus rouxii, Temminck, Mon. Mamm. ii. p. 30 *b*.

♂. Chin Teh, Anhwei.

A small, almost uniform reddish-brown Bat; the forearm measures 45 millim., or 1·75 inch.

VESPERTILIO DISCOLOR SUPERANS.

Vespertilo discolor superans, Thomas, P. Z. S. 1898, p. 770.

Sa Sa hu, Ichang.

This large form described recently seems well worthy of the distinguishing name that has been applied. In the present specimen the forearm measures 54 millim., the thumb without the claw 7.

NECTOGALE ELEGANS.

Nectogale elegans, M.-Edw. C. R. Acad. Sci. 1870, t. lxx. p. 341; Rech. Mamm. 1874, p. 266, pls. 39, 39 A. fig. 1.

♀. Yang-liu-pa, N.W. Sechuen.

This specimen agrees in every particular with the description given by M. Milne-Edwards.

There are two specimens of *Nectogale* from Sikhim in the British Museum; these two are larger and much more brown in colour, and have the lower parts of a much less pure white, the colour of the upper parts blending with that of the lower, there being no sharp dividing line. The whole tint of the animal is more brown, the pale ridges of the tail are buff-coloured, and even the longer glistening hairs of the body are inclined to yellow. When wet the iridescent colours are purple and not green.

In its dentition the most evident distinction is, that the shorter cusp of the large incisor is cut away so that the line of the anterior edge of this cusp is continuous with the anterior edge of the next tooth. I name this Himalayan form *Nectogale sikhimensis*.

I have taken as a type No. 96. 1. 1. 9 in the British Museum, collected by Surg.-Maj. Waddell, Oct. 1891, at Lathong, 10,000 ft. alt.

CHIMARROGALE STYANI, sp. n.

Above uniform dark slate-black; from the shoulders backwards interspersed with shining white hairs, which increase in length and numbers on the rump, similar to but to a far less extent than found in *Nectogale*; all the underparts, with the upper lip and side of face to the height of the eye, white washed with yellow, a sharp line dividing the dark and light surfaces. Fore and hind feet white except a narrow line on the dorsal surface running towards the 5th finger and toe on the outer side. Tail almost exactly as in *Neomys* (= *Crossopus*); and in fact the whole animal so closely resembles our Water-Shrew that it is hard to believe that it does not belong to the same genus.

Breadth of skull across squamosals 11 millim., narrowest interorbital constriction 5, front of incisors to back of palate 11·7, greatest width outside molars 7, tip of incisors to tip of pm. 4 5. Mandible—greatest length (tip of incisors to condyle) 14; angle to coronoid 5.

"♀ length 6 inches; eyes black."

Type B.M. No. 99. 3. 1. 8.

Yang-liu-pa, N.W. Sechuen, 16 June, 1897.

Measurements of dry skin: head and body 108 millim., tail 61, hind foot 20.

Very slight stain on the teeth, perhaps rather less than in *C. himalaica*; viewed from the side, the three intermediate teeth are subequal, slightly longer than the front cusp of pm. 4; viewed from above, the first of these small teeth appears rather larger than either of the two posterior, which are equal.

SORICULUS HYPSIBIUS, sp. n.

The entire animal almost uniformly coloured dull dark brown-soot colour, the underparts only very slightly paler in tint; the fore and hind feet pale; the tail long; teeth $\frac{3}{3}=28$.

♂. Yang-liu-pa, November, 1897.

Type B.M. No. 99. 3. 1. 10.

Measurements taken from the dried skin: head and body 84 millim., tail 65, hind foot 15.

Skull—width across squamosals 8·7, narrowest interorbital constriction 4·7, front of incisors to back of palate 9, width outside ms. 1 6·1, tip of incisors to tip of pm. 4 3·6. Mandible—greatest length (tip of incisors to tip of condyle) 12·3, to angle 11·5; angle to coronoid 4·5.

The first five teeth in the upper jaw are tipped with red, the colour extending on the teeth in proportion to their size; of the three intermediate teeth the first is about double the size of either of the others, the second being only very slightly longer than the last.

In the lower jaw the first three teeth only are tipped with red. There is no red on the molars of either jaw. The lower jaw has a very short and small angle. The skull is lighter, narrower, and lower in the facial portion than *S. minor* from Manipur.

There is no trace of any small vestigial tooth in front of the large upper premolar. The definition of the genus will therefore have to include animals with from 28 to 32 teeth, and in so handy and small a genus there is no need for further subdividing it.

TALPA LONGIROSTRIS.

Talpa longirostris, M.-Edw. C. R. Acad. Sci. lxx. 1870, p. 341; Rech. Mamm. p. 281, pl. 38. fig. 2, pl. 17 A. fig. 2 (1871).

♂. Yang-liu-pa, N.W. Sechuen.

The single specimen of this rare Mole is uniformly coloured black with no brown shade in the fur, as suggested by the figure accompanying the original description of the species.

ÆLUROPUS MELANOLEUCUS.

Ailuropus melanoleucus, M.-Edw. Rech. Mamm. p. 321 (1870).

♂. Yang-liu-pa.

ARCTOMYS HIMALAYANUS.

Arctomys himalayanus, Hodgson, J. A. S. B. 1841, x. p. 777.
A. robustus, M.-Edw. Nouv. Arch. Mus. t. vii. 1870, p. 92.

2 skins, N.W. Sechuen.

These two specimens seem to agree in every respect with skins of *A. himalayanus* from Sikhim in the British Museum. The skulls have unfortunately been lost, but the want is filled up by those of specimens obtained by Berezowski in the same locality; and as these agree likewise with the skulls of *A. himalayanus*, I shall follow Dr. Blanford (Mamm. Second Yarkand Mission, p. 36) in regarding the name *A. robustus* as a synonym of this species.

CRICETUS (CRICETULUS) OBSCURUS.

Cricetus (*Cricetulus*) *obscurus*, M.-Edw. Rech. Mamm. p. 136, pl. 12. fig. 3, pl. 13. figs. 3, 3 *b* (1874).

♂, ♂, ♂, ♂, ♀. North Shantung.

These agree in every way with the figures and description of the species, and also with a specimen in the British Museum labelled Siberia, but which may possibly be one of Père David's collecting, as it was obtained from an agent in Paris.

CRICETUS (CRICETULUS) TRITON, sp. n.

Colour uniform drab, fur rather richer in tone on the dorsal line, but no distinct streak; underparts whitish, the blue-grey of the bases of the fur mixing with the white of the extreme tips.

♂, ♀. N. Shantung, 24 May, 1898.

Type ♀. No. 99. 3. 1. 14 in the British Museum.

Measurements taken from dried skin: head and body 150 millim., tail 65, hind foot without claws 21, ear (c.) 16 × 14.

Skull—greatest length 34, greatest breadth 19·7, breadth of brain-case 15, narrowest interorbital constriction 5·5, length of nasals 12·1, back of incisors to back of palate 15·3, length of palatal

foramina 7, length of diastema 9·9, length of molar series 5·1, across molar series 7. Mandible—tip of incisors to condylar process 23·5, to coronoid 19·5, coronoid to angle 10·1; bulla, antero-posterior length 8.

Molars in almost parallel rows. Upper incisors rather darker than lower, pale orange.

The length of the tail in proportion to its size, and also the characters and general shape of the skull, show that this species is more closely allied to *C. longicaudatus* than to any of the other known forms; the size, however, is so much greater, that there can be no hesitation in distinguishing it under a separate name. The two specimens agree absolutely in every way. Mr. Styan compared one of the specimens with the type of *C. longicaudatus* in the Paris Museum, and considers them perfectly distinct species.

LEPUS SECHUENENSIS, sp. n. (Plate XXXII.)

In the general pattern of the markings, the shape and length of the ears, and the texture of the fur resembling *L. europæus*. The fur of almost the whole of the upper surface has long black tips with a subterminal fawn-coloured band, and, owing to the coat being much waved, a very rich mottling is produced; the underfur is drab-white; the nape dull greyish brown; the shoulders and fore legs red-fawn; the backs and bases of the outside of the ears blue ash-grey; the tips of the ears are edged with black, and there is a large spot of this colour extending an inch or more down the ears on the hinder surface; the cheeks in front of the eyes grey; the rump and thighs ash-grey; the belly is pure white, but the fur is greyish at the extreme base; the tail is rather long, dark grey above, the broad black line extending the whole length, but most of the hairs have white tips; beneath, the hairs of the tail are grey for more than half their length, with pure white tips.

Type in the British Museum, No. 99. 3. 1. 19.

Collector's note: "♀, Dunpi, N.W. Sechuen, October, 1897; eyes yellow-brown."

Another specimen obtained at the same time is not labelled.

The skull of this Hare very closely resembles that of *L. hypsibius*, Blanford, Mamm. Sec. Yarkand Mission, 1879, pl. iv. *a*. fig. 1, the only apparent difference being that it is rather larger in every measurement, its greatest length being 97 millim., or about a quarter of an inch longer than the figure, a difference of no value whatever.

In describing this species as distinct, I am therefore relying solely upon external characters; the principal of which, in the absence of specimens of *L. hypsibius* for comparison, must be the colour of the ears and the tail—two very characteristic features among Hares; in these two forms they are as distinct as it is possible to be.

The pure French grey of the back of the ears and the large jet-black tips are particularly striking; the tail with the black upper

surface only frosted with white must be very different to the "tail white throughout" of *L. hypsibius*.

There is no other Hare in any way nearly related to this Sechuen form, *L. oiostolus* (=*L. pallipes*) being a far smaller animal; and although the skins at my disposal are in too bad condition to make fair comparison, the skulls show very wide differences, and prove that these two Hares belong to quite distinct groups.

The grooves of the upper incisors are filled with cement; the infolded enamel, seen on the cutting-edge of the tooth, has its sides almost in contact, so that the cement forms a simple straight line, rather nearer the inner than the outer edge of the tooth. The front face of each tooth is almost evenly sloped off towards the sides, the portion on the inner side of the grooves being only very slightly or barely perceptibly raised.

LEPUS SWINHOEI.

Lepus swinhoei, Thomas, Ann. Mag. N. H. ser. 6, vol. xiii. p. 364 (1894).

♂. Mahsien, Shensi.

OCHOTONA TIBETANA.

Lagomys tibetanus, M.-Edw. Rech. Mamm. p. 314, pls. 48, 49. fig. 1.

This little Pika is very much like *O. roylii* from Sikhim, but is a smaller animal.

I now add Mr. Styan's notes on seven species of Chinese Squirrels:—

1. SCIURUS VULGARIS L. (probably subsp. *calotus* Gray.)

Pekin. Greyish black above.

2. SCIURUS DAVIDIANUS M.-Edw.

Pekin, N.W. Sechuen, Shensi, Hupeh.

A mountain species, probably mostly found at high altitudes. *S. davidianus consobrinus* Berezowski does not seem really separable.

3. SCIURUS PERNYI M.-Edw.

West Hupeh, North Kweichow, Anhwei, N.W. Fokien, Yunnan.

A mountain species probably not descending below 3000 ft. *S. flavipectus* David, Journ. 3me Voy., refers to this Squirrel.

4. SCIURUS PYRRHOMERUS Thos.

Ichang and Sinyang (Kweichow).

Also a mountain species; only found hitherto in the above mentioned two localities.

5. SCIURUS CASTANEOVENTRIS Gray.

Chekiang, Fokien, &c.

A mountain species found right down to the foot of the hills, but not extending on to the plains; common in above two maritime provinces.

I once entered a hillside hollow, one side of which was a rocky precipice about 50 ft. high. On the ledges of this a score or two of Squirrels were collected, and many others were in some small firs in the centre of the hollow; there appeared to be a large colony of them.

6. SCIURUS STYANI Thos.

? *Macroxus chinensis*, Gray, Ann. Mag. N. H. ser. 3, xx. 1867, p. 282.

Macroxus griseopectus, Gray, loc. cit. (nec Blyth).

Sciurus styani, Thomas, Ann. Mag. N. H. ser. 6, xiii. 1894, p. 363.

I think there is little doubt that these names all refer to one species. Some years ago I pointed out to Mr. Thomas that these pale-yellow bellied Squirrels (*S. griseopectus* of Gray) were distinct from *S. castaneoventris*, to which species they were assigned in the Museum. Finding the former name was preoccupied, Mr. Thomas renamed the species after me; but an examination of the old faded types of Gray's *S. chinensis* leads me to think that this form had no need of a new name. The skulls, however, have not been removed from the types of this latter form, so there is just a possibility that there are two species, for one of which we do not know the locality.

Its range appears to be the Yangtse valley from Kiu Kiang (Kiangsi) downwards (possibly found higher up the valley, but I have not met with it), spreading over the delta, where it is very common on the flat country between Shanghai and Hangchow. It is mostly confined to the plains, but is found occasionally on the low foot-hills.

7. SCIURUS SWINHOEI M.-Edw.

S. macclellandii var. *swinhoei*, M.-Edw. Rech. Mamm. p. 308 (1868).

N.W. Sechuen, Chinteh, Chekiang, Fokien.

It will be noticed that this species ranges from the extreme west of China to the coast, and is found at altitudes ranging from 500 ft. to 5000 ft. and probably much higher. A series of about 50 skins has not enabled me to find any constant characteristics by which subspecies can be clearly separated. I have not come across the far brighter and handsomely striped *S. rodolphi* (so labelled in the British Museum) in the districts in which my collections have been made.

EXPLANATION OF THE PLATES.

PLATE XXXI.

Rhinopithecus roxellanæ (male), p. 572.

PLATE XXXII.

Lepus sechuenensis, p. 576.

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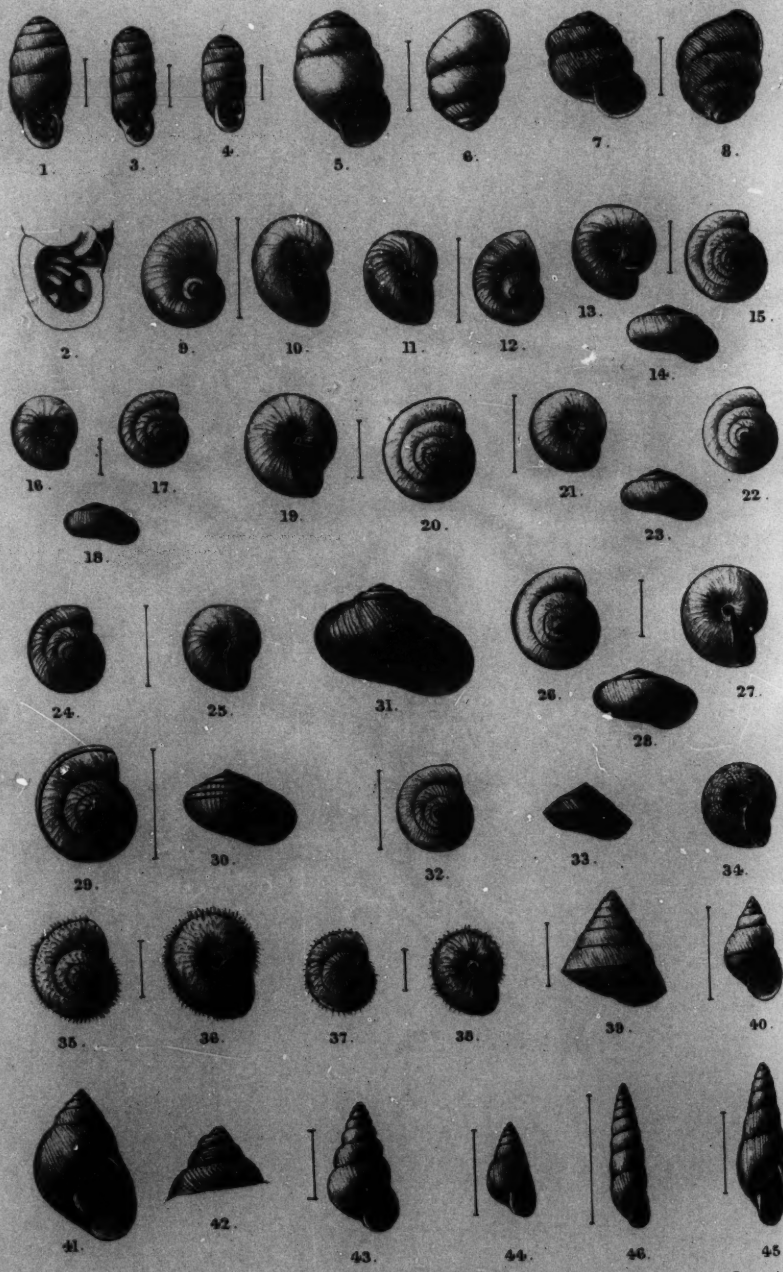

J.Green del. et lith.

Mintern Bros. imp.

CENTRAL AFRICAN LAND-SHELLS.

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J. Green del. et lith.

Mintern Bros. Chromo.

CENTRAL AFRICAN LAND-SHELLS.

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J. Green del. et lith. Mintern Bros. Chromo.

CENTRAL AFRICAN LAND-SHELLS.

3. On a Collection of Land-Shells from British Central Africa. By Edgar A. Smith, F.Z.S.

[Received April 13, 1899.]

(Plates XXXIII.–XXXV.)

The collection about to be described was presented to the British Museum by Sir Harry Johnston in 1896 and 1897, and a brief notice of a portion of it has already appeared in his book on 'British Central Africa' (pp. 363, 364). It is of special interest, as very little is known respecting the terrestrial Mollusca of this particular region. The country to the north and east, in German East Africa, has been conchologically explored by many collectors, and a very valuable report upon the fauna has been given by Dr. E. von Martens, in 1897, in a work entitled 'Beschalte Weichthiere Deutsch-Ost-Afrikas.' Only a very few species, however, had previously been collected in Nyassaland, and reference to these has already been made by the writer in the Society's 'Proceedings' for 1891, p. 309. Although the present collection contains examples of as many as twenty-five new species out of a total of forty-four enumerated, none of them are representatives of new generic types, and the forecast given in the paper referred to has, judging by the present collection, proved to be correct in every respect[1]. The "interesting intermediate links connecting some of the large species of *Achatina*" have been met with, and a number of new species of other groups of Helicidæ "have been found." In working out this collection much difficulty was experienced in determining the *Achatinæ*. The species appear to grade one into the other, and the more examples we have, the greater the trouble becomes. The genus is spread over the greater part of Central and West Africa, as far north as Senegambia, and each district seems to produce its special race, a modification of some neighbouring form; so that the separation of species becomes more and more difficult through the discovery of intermediate links from every fresh locality. The same may be said of the *Enneæ*, and indeed of most of the other groups.

The specimens were obtained by Mr. Alexander Whyte, or under his direction, at the following localities:—

(1) Nyika Plateau, 7000 feet, towards the north end of Lake Nyasa, on the west side; (2) Mount Zomba, 6000 feet; (3) Zomba Plateau, 5000 feet; (4) Mount Chiradzulu, 5000 feet; and (5) Malosa, 6000 feet, all to the south of the lake. The Masuku Plateau 6000–7000 feet, where several of the specimens were obtained, is also probably in the same region.

[1] The collection also contained a few slugs, including *Atoxon tæniatum* Simroth (?) and a species of *Veronicella*.

1. STREPTOSTELE COSTULATA Martens.

Streptostele costulata, Martens, Weichth. Deutsch-Ost-Afrikas, p. 34, pl. ii. fig. 33.

Hab. Nyika Plateau, 7000 feet.

A single specimen may belong to this species. It agrees very closely with a typical example from Butumbi, but is rather smaller, more slender, and the whorls are rather higher in proportion to the width.

2. ENNEA (UNIPLICARIA) HAMILTONI Smith.

Ennea hamiltoni, Smith in H. H. Johnston's 'British Central Africa,' p. 364 (1897).

Ennea johnstoni, Smith, Proc. Zool. Soc. 1893, p. 633, pl. lix. fig. 1.

Hab. Mount Zomba, 6000 feet; Malosa, 6000 feet.

The specimens from the latter locality are considerably larger than the types from Fort Johnston, the oblique sculpture is a trifle coarser, and the parietal denticle is entirely absent or only very faintly indicated. The form is variable, as shown by the following measurements:—

Length 27½ millim.	Width 12.
„ 24 „	„ 13.

3. ENNEA (GULELLA) LÆVIGATA Dohrn.

Ennea lævigata, Dohrn, Proc. Zool. Soc. 1865, p. 232; Martens, Weichth. Deutsch-Ost-Afr. p. 21.

Hab. Zomba Plateau; Masuku Plateau, 6000–7000 feet; Nyika Range, 7000 feet; Mount Chiradzulu.

Somewhat variable in size and in the development of the upper of the two labral teeth. This in the type is somewhat bifid or tuberculated as described by Dohrn, whereas in the specimens in the present collection it is simple, sometimes of the same size as the adjacent tooth, but sometimes a trifle larger.

4. ENNEA (GULELLA) VICINA, sp. nov. (Plate XXXIII. figs. 1, 2.)

Testa breviter cylindracea, rimata, subpellucido-albida, nitida, oblique leviter striata, striis infra suturam distinctioribus; anfractus 6½, convexi, ultimus penultimo angustior, pone labrum indentatus; apertura parva, ringens, dentibus pluribus inæqualibus munita; dens parietalis magnus, lamelliformis, labro junctus; dentes columellares tres, tres supra labrum, tres ad basin; peristoma leviter incrassatum, expansum et reflexum.

Longit. 7 *millim., diam.* 3½; *apertura* 2½ *longa.*

Hab. Mount Chiradzulu and Zomba Plateau at 5000 feet.

Allied to *E. triplicaria* Martens, but differing in the labral teeth, and also in the almost total absence of a second parietal tooth. Although depicted in the figure, Martens does not mention

the two small denticles at the base of the aperture rather far within from the margin. These occur also in the present species in the same position. The teeth on the columella are divergent and situated on a prominence. Those on the outer lip might be described as two in number, whereof the upper is somewhat irregularly bipartite.

5. Ennea (Gulella) fortidentata Smith, var.

Ennea fortidentata, Smith, Ann. Mag. Nat. Hist. 1890, vol. vi. p. 162, pl. vi. fig. 6; Martens, Weichth. Deutsch-Ost-Afr. p. 21.

Hab. Nyika Range, 7000 feet.

Generally a trifle stouter than the typical form from Mamboia, and without the minute parietal tooth above the columella.

6. Ennea (Gulella) varians, sp. nov. (Plate XXXIII. figs. 3, 4.)

Testa cylindracea, rimata, pellucida, albida, oblique tenuiter costulata; anfractus 8, *lente accrescentes, sutura profunda leviter obliqua sejuncti, superiores duo (protoconcham constituentes) læves, convexi, cæteri convexiusculi; ultimus duobus præcedentibus angustior, pone labrum indentatus; apertura parva, intus quadridentata; dens parietalis unicus lamelliformis, prominens, dextrorsum concavus, prope labrum situs, alius paulo minor supra medium labri, tertius minimus ad basin aperturæ, quartus columellaris, maximus; peristoma utrinque expansum, subreflexum, leviter incrassatum.*

Longit. 6 *millim., diam.* 2; *apertura fere* 2 *longa.*

Hab. Mount Chiradzulu and Zomba Plateau, 5000 feet.

The parietal lamellar tooth is short, not extending far within, and the columellar fold is broad, jutting out prominently across the aperture. Another example in rather bad condition is somewhat longer, having a length of $7\frac{1}{2}$ millim., although consisting of the same number of whorls.

The two specimens from the Zomba Plateau are smaller, shorter, and have only seven whorls. In other respects they agree precisely with the type. Length 5 millim., diam. 2.

7. Streptaxis johnstoni, sp. nov. (Plate XXXIII. figs. 5, 6.)

Testa ovata, parum obliqua, rimata, albida, lineis incrementi obliquis tenuissimis striata; anfractus $6\frac{1}{2}$, *convexi, infra suturam crenulati, ultimus paulo descendens; apertura obliqua, longit. totius* $\frac{1}{2}$ *fere æquans; peristoma vix incrassatum, leviter expansum, margine columellari reflexo.*

Longit. 10 *millim., diam.* $6\frac{1}{2}$; *apertura* $4\frac{2}{3}$ *longa.*

Hab. Nyika Range and Zomba Plateau.

Allied to *S. denticulatus* Dohrn and *S. pusillus* Martens. The so-called "*Ennea vitrea*" of Morelet from Angola is also very similar, yet distinct.

8. STREPTAXIS KIRKI Dohrn. (Plate XXXIII. figs. 7, 8.)

Streptaxis kirkii, Dohrn, Proc. Zool. Soc. 1865, p. 232; Martens Weichth. Deutsch-Ost-Afrikas, p. 32.

Hab. Zomba Plateau, 5000 feet.

9. HELICARION NYASANUS, sp. nov. (Plate XXXIII. figs. 9, 10.)

Testa tenuissima, pellucida, albida, vix nitens, lineis incrementi leviter plicatis striata, depressa, ambitu subovata; spira depressa, apice obtuso, prominulo; anfractus tres, convexi, infra suturam depresse marginati, margine subcrenulato, ultimus subtus in medio membranaceus; apertura fere horizontalis, latissime lunata.

Diam. maj. 16 *millim.*, *min.* 11, *alt.* 7½.

Hab. Mount Chiradzulu, Masuku Plateau, 6000–7000 feet, and Nyika Range, 7000 feet.

Very thin, depressed above, membranaceous beneath at columellar margin, with somewhat plicate lines of growth.

10. HELICARION MASUKUENSIS, sp. nov. (Plate XXXIII. figs. 11, 12.)

Testa H. nyasano *minor, minus depressa, rotundior, minus fragilis, infra haud membranacea, lineis incrementi minus plicatis; apertura angustior, margine columellari ad insertionem incrassato, albo, reflexo, rimam umbilicalem formante, margine externo callo tenuissimo juncto.*

Diam. maj. 14 *millim.*, *min.* 10⅔, *alt.* 7.

Hab. Masuku Plateau, 6000–7000 feet, Nyika Range, 7000 feet, Mount Chiradzulu and Zomba Plateau, 5000 feet.

The whorls, as in *H. nyasanus*, are three in number, but the spire is a little more elevated.

11. KALIELLA BARRAKPORENSIS Pfeiffer.

Helix barrakporensis, Pfeiffer, Proc. Zool. Soc. 1852, p. 156; Conch.-Cab. ed. 2, p. 415, pl. 147. figs. 20–22; Reeve, Con. Icon. fig. 816; Tryon, Man. Conch. ser. 2, vol. ii. p. 61, pl. xxvi. figs. 57, 58; Godwin-Austen, Land & Freshwater Moll. India, vol. i. pp. 2, 19, 146, pls. i., ii., v., xxxviii.

Helix (*Trochonanina*) *pretoriensis*, Melvill & Ponsonby, Ann. Mag. Nat. Hist. 1890, vol. vi. p. 469.

Hab. Mount Chiradzulu.

Occurring also in North and South India, Madagascar, Pretoria, S. Africa, and Ashanti. Specimens from these localities, which I cannot in any way separate, are in the Museum Collection. They doubtless have been transported from place to place, as seems to have been the case with the well-known *Eulota similaris* and various species of *Subulina* and *Opeas*.

12. THAPSIA MIXTA, sp. nov. (Plate XXXIII. figs. 13, 14, 15.)

Testa pallide cornea, anguste perforata, depressa, orbicularis, nitida, lineis incrementi inconspicuis striisque spiralibus micro-

scopicis sculpta; spira parum elata, subconvexe conoidea; anfractus 5½, lente accrescentes, convexiusculi, infra suturam anguste marginati; apertura oblique lunata, margine columellari superne breviter dilatato et reflexo.

Diam. maj. 7½ *millim., min.* 6½, *alt.* 4.

Hab. Mount Chiradzulu.

Flatter than *T. hanningtoni*, columella more oblique and reflexion different.

13. Thapsia insimulans, sp. nov. (Plate XXXIII. figs. 16, 17, 18.)

Testa minima, fusco-cornea, nitida, depressa, orbicularis, perforata, lineis incrementi tenuibus striisque spiralibus minutis sculpta; spira brevissime conoidea, ad apicem obtusa; anfractus 4½, *lente accrescentes, convexiusculi, anguste marginati, ultimus infra spiraliter distinctius striatus; peristoma tenue, margine columellari leviter expanso, vix reflexo.*

Diam. maj. 5 *millim., min.* 4½, *alt.* 3.

Hab. Mount Chiradzulu.

Quite distinct from *T. hanningtoni* and *T. depressior* Smith[1] from Mamboia.

14. Thapsia masukuensis, sp. nov. (Plate XXXIII. figs. 19, 20.)

Testa angustissime semiobtecte perforata, depressa, orbicularis, tenuis, polita, fusco-cornea; spira breviter conoidea ad apicem obtusa; anfractus 5½, *convexi, lente crescentes, anguste marginati; apertura obliqua, lunata; peristoma tenue, margine columellari ad insertionem incrassato, albo, expanso, peculiariter reflexo, umbilicum semiobtegente.*

Diam. maj. 9 *millim., min.* 7⅔, *alt.* 5½.

Hab. Masuku Plateau, 6000–7000 feet.

The sculpture consists of faint lines of growth which are finely plicate near the suture, and very minute, almost imperceptible spiral striation.

15. Thapsia simulata, sp. nov. (Plate XXXIII. figs. 21, 22, 23.)

Testa depressa, orbicularis, anguste umbilicata, solidiuscula, nitida, supra fuscescens, infra pallida; spira brevissime conoidea, ad apicem obtusa; anfractus 5, *convexi, infra suturam impresse marginati, sublente crescentes, lineis incrementi obliquis arcuatis leviter striati, ultimus ad peripheriam rotundatus; apertura oblique lunata; peristoma tenue, margine columellari ad insertionem late dilatato et reflexo.*

Diam. maj. 11⅓ *millim., min.* 10, *alt.* 7.

Hab. Mount Chiradzulu.

More solid and more depressed than *T. nyikana*, with a wider umbilicus, and smaller aperture and body-whorl.

[1] Ann. Mag. Nat. Hist. 1890, vol. vi. p. 151.

16. THAPSIA NYIKANA, sp. nov. (Plate XXXIII. figs. 24, 25.)

Testa orbicularis, depressa, anguste umbilicata, tenuis, subpellucido-cornea, nitida, lineis incrementi leviter subplicatis sculpta; spira breviter conoidea, ad apicem obtusa; anfractus 5, convexi, lente accrescentes, infra suturam impresse marginati; apertura oblique lunata; peristoma tenue, margine columellari ad insertionem breviter expanso et reflexo, albo, umbilicum haud tegente.

Diam. maj. 12 *millim.*, *min.* 10½, *alt.* 8.

Hab. Nyika Range, 7000 feet.

The largest of the genus now described. The species cannot be identified except by actual comparison, figures and descriptions being of very little use.

17. THAPSIA DECEPTA, sp. nov. (Plate XXXIII. figs. 26, 27, 28.)

Testa T. masukuensi *similis, sed minor, latius perforata, depressior; anfractibus quinque, magis celeriter crescentibus, ultimo (spiræ respondente) majori; margine columellari vix reflexo, minime incrassato vel expanso.*

Diam. maj. 8½ *millim.*, *min.* 7, *alt.* 4½.

Hab. Masuku Plateau, 6000–7000 feet.

Quite distinct from *masukuensis*, although very like in colour and general appearance until closely compared.

18. ZINGIS WHYTEI, Smith. (Plate XXXIII. fig. 31.)

Helix (*Pella*) *whytei*, Smith, Proc. Zool. Soc. 1893, p. 634, pl. lix. figs. 3, 4.

Hab. Mount Chiradzulu.

Some of the specimens from this locality are larger than the types, the largest having a diameter of 25 millim.

19. ZINGIS JOHNSTONI, sp. nov. (Plate XXXIII. figs. 29, 30.)

Testa depressa, anguste umbilicata, tenuissima, cornea, lineis duobus angustis rufis cincta, lineis incrementi tenuibus striisque spiralibus minutis sculpta; spira breviter conoidea, ad apicem obtusa; anfractus 5, regulariter, haud celeriter crescentes, convexi, ultimus ad peripheriam obtuse angulatus, haud descendens, infra vix concentrice striatus; apertura obliqua, lunata; peristoma tenue, margine columellari ad insertionem breviter reflexo.

Diam. maj. 16 *millim.*, *min.* 13, *alt.* 10.

Hab. Masuku Plateau, 6000–7000 feet.

Allied to *Z. episcopalis* Smith and *Z. radiolata* Martens.

20. MARTENSIA CONSOCIATA, sp. nov. (Plate XXXIII. figs. 32, 33, 34.)

Testa depresse conoidea, umbilicata, tenuis, pallide cornea, striis incrementi obliquis tenuissimis confertis sculpta, infra striis concentricis conspicuis ornata; spira breviter conoidea, ad apicem obtusa; anfractus sex, lente accrescentes, convexi, sutura profunda sejuncti, supra sed ad suturam carina marginati

ultimus ad peripheriam acute angulatus et carinatus; apertura oblique angulato-lunata; peristoma tenue, margine columellari supra late expanso et reflexo.

Diam. maj. 12 *millim., min.* 10, *alt.* 7.

Hab. Masuku Plateau, 6000–7000 feet.

More widely unbilicated than *M. mozambicensis*, less sharply keeled, much more delicately sculptured above, &c. The lower surface is more glossy than the upper, which has a silky appearance in nicely washed specimens.

21. MARTENSIA MOZAMBICENSIS Pfeiffer.

Helix mozambicensis, Pfr. Proc. Zool. Soc. 1855, p. 91, pl. xxxi. fig. 9; Martens, Weichth. Deutsch-Ost-Afrikas, p. 46, as *Martensia* (synonymy and references).

Hab. Masuku Plateau, 6000–7000 feet; Zomba Plateau, 5000 feet; Nyika Range, 7000 feet; Mount Chiradzulu.

Widely distributed in East Central Africa, and varying in height of spire, strength of sculpture, convexity of whorls, &c.

22. PHASIS (TRACHYCYSTIS) FUSCO-CORNEA, sp. nov. (Plate XXXIII. figs. 35, 36.)

Testa depressa, orbicularis, mediocriter umbilicata, tenuis, pallide fusco-cornea, epidermide conspicue pilosa induta; spira fere plana, apice vix elato; anfractus 4½, *convexiusculi, sutura profunda sejuncti, sublente accrescentes, rugose striati et punctati, ultimus antice leviter descendens, ad peripheriam obtuse subangulatus; apertura obliqua, late lunata; peristoma tenue, margine columellari ad insertionem dilatato et leviter reflexo.*

Diam. maj. 9 *millim., min.* 7½, *alt.* 5.

Hab. Zomba Plateau, 5000 feet.

The hairs of the periostracum are rather long, and when rubbed off the surface has a rough pitted appearance.

23. PHASIS (TRACHYCYSTIS) FUSCO-OLIVACEA, sp. nov. (Plate XXXIII. figs. 37, 38.)

Testa P. fusco-corneæ *similis, sed minor, fusco-olivacea, angustius umbilicata; anfractibus* 4½, *minus convexis, sutura minus profundus sejunctis, ultimo vix descendente.*

Diam. maj. 7 *millim., min.* 6, *alt.* 3⅔.

Hab. Masuku Plateau, 6000–7000 feet; Nyika Plateau, 7000 feet.

When the hairy periostracum is rubbed off, the surface above and below exhibits lines of growth and spiral striation.

24. TROCHOZONITES SHARPEI, sp. nov. (Plate XXXIII. fig. 39.)

Testa elate conica, ad peripheriam carinata, anguste perforata, tenuis, nitida, flavescenti-cornea, lineis incrementi tenuibus obliquis sculpta; spira producta, subconcava, ad apicem obtusa; anfractus 7½, *lente accrescentes, apicales perconvexi, cæteri sensim minus rotundati, supra suturam filo-carinati, ultimus in medio*

acute albo-carinatus, infra convexiusculus; apertura obliqua, angulato-lunata; peristoma tenue, margine columellari superne late reflexo, umbilicum semiobtegente.

Diam. maj. 8½ *millim., min.* 8, *alt.* 9.

Hab. Mount Chiradzulu.

Var. *anfractibus convexioribus, ultimo ad peripheriam angustiore.*

Hab. Masuku Plateau, 6000–7000 feet.

25. Buliminus (Rhachis) stictus Martens.

Bulimus (*Rhachis*) *stictus*, Martens, Mal. Blätt. 1859, vol. vi. p. 211, pl. ii. fig. 6.

Hab. Nyasaland (*Kirk and Whyte*); Tette, Mozambique (*Martens*).

Of four specimens from Nyasaland only one has the two pale rosy bands of the type. Martens describes the four apical whorls as uniformly yellow, whereas all the specimens I have examined have in these whorls a black zone just above the suture.

26. Buliminus (Rhachis) böhmi Martens.

Bulimus (*Rhachis*) *böhmi*, Martens, Nachr. Deutsch. mal. Gesell. 1895, p. 181; Beschalte Weichth. Deutsch-Ost-Afrikas, p. 70, pl. iii. fig. 39.

Hab. Mount Chiradzulu, 5000 feet.

The specimens in the present collection are rather smaller than the type, which was obtained further north on the east side of Lake Tanganyika. The largest specimen is only 19 millim. in length.

27. Buliminus (Rhachis) chiradzuluensis, sp. nov. (Plate XXXIII. fig. 40.)

Testa ovato-conica, tenuis, vix perforata, straminea, lineis duabus fuscis circa medium anfractus ultimi ornata, nitens, lineis incrementi tenuibus obliquis striata; spira conica, versus apicem mediocriter obtusum sordide rufescens; anfractus sex, convexiusculi, ultimus in regione umbilici pellucidus; apertura irregulariter ovata, longit. totius ½ æquans; intus bilineata; peristoma tenue, margine columellari anguste reflexo, appresso, rimam inconspicuam formante.

Longit. 13½ *millim., diam.* 8¾.

Hab. Mount Chiradzulu.

Allied to *B. usagaricus* Smith, but thinner, yellower, with a narrower perforation and a differently reflexed columella. I cannot agree with Dr. von Martens in considering *B. usagaricus* a variety of *B. melanacme* of Pfeiffer.

28. Buliminus (Conulinus) nyasanus, sp. nov. (Plate XXXIII. figs. 41, 42.)

Testa globoso-ovata, tenuis, umbilicata, pallide fuscescens, subpellucida, oblique tenuiter costulato-striata; spira conica, ad apicem subplana; anfractus 6, *superiores* 2½ *(protoconcham formantes) convexiusculi, spiraliter fortiter lirati, cæteri convexi, ultimus globosus, haud descendens; apertura subperpendicularis,*

longit. tolius ¼ æquans; peristoma tenue, simplex, margine columellari reflexo, umbilicum mediocrem partim obtegente.

Longit. 21 *millim., diam.* 15; *apertura* 12 *longa*, 7 *lata.*

Hab. Nyika Plateau, 7000 feet, Mount Chiradzulu and Zomba Plateau, 5000 feet.

Remarkable on account of the spirally lirate protoconch, the difference of sculpture of the normal whorls being sharply defined.

29. Buliminus (Conulinus) metuloides, sp. nov. (Plate XXXIII. fig. 43.)

Testa conica, anguste umbilicata, tenuis, pallide fusco-cornea, nitida, oblique tenuiter striata, ad apicem obtusa; anfractus 6–7, *rotundati, regulariter accrescentes, sutura leviter obliqua sejuncti; apertura fere perpendicularis; peristoma tenue, simplex, margine columellari expanso et reflexo, umbilicum semiobtegente.*

Longit. 10 *millim., diam.* 6.

Hab. Zomba Plateau, 5000 feet.

Closely allied to *B. metula* Martens[1], but, although larger, consisting of fewer whorls. Professor v. Martens writes concerning specimens sent for his examination:—"Very near to my *metula*, but a little broader and lower than all my specimens. Also the umbilicus is a little broader in my examples."

30. Buliminus boivini (Morelet).

Glandina boivini, Morelet, Séries Conch. p. 72, pl. v. fig. 5.

Bulimus (*Cerastes*) *mamboiensis*, Smith, Ann. Mag. Nat. Hist. 1890, vol. vi. p. 153, pl. v. fig. 7.

Hab. Nyika Range, 7000 ft., Mount Chiradzulu, 6000–7000 ft., Masuku Plateau, 6000–7000 ft., Malosa, 6000 ft., Zomba Plateau, 5000 ft.

This species is very variable in size and form judging from the series of specimens from the above localities. It also has a wide range, the type being found to the north at Mombasa.

Dr. E. von Martens[2] has erroneously placed the *Buliminus ptychaxis* as a synonym of this species, which does not possess the distinct columellar fold which is characteristic of that form from Ujiji.

The following measurements will show the great variation in size which occurs in the present species:—

	Length.	Width.	Length of aperture.
	mm.	mm.	mm.
(1).....	25	10	9
(2).....	20	10	8
(3).....	14	7½	6

Number 1 consists of 8½ whorls, no. 2 of 7½ whorls, and no. 3 of 6½, all appearing equally adult.

[1] Weichth. Deutsch-Ost-Afrikas, p. 66, pl. iii. fig. 27.
[2] Beschalte Weichth. Deutsch-Ost-Afrikas, p. 61.

31. CURVELLA NYASANA, sp. nov. (Plate XXXIII. fig. 44.)

Testa elongata, ovato-conoidea, albida, subpellucida, anguste umbilicata, lineis incrementi valde curvatis costuliformibus sculpta; spira elongato-conica, ad apicem obtusa; anfractus 6–6½, convexiusculi, regulariter lente crescentes, sutura leviter obliqua sejuncti; apertura ovata, superne acuminata, longit. totius ⅓ subæquans; peristoma tenue, margine dextro in medio prominente curvato, ad suturam valde recedente, columellari obliquo, valde expanso et reflexo.

Longit. 12½ *millim., diam.* 6½; *apertura* 6 *longa*, 3 *lata.*

Hab. Mount Chiradzulu, Masuku Plateau, 6000–7000 feet; Nyika Range, 7000 feet.

Var. *Testa typo major, latior, spira breviore, anfractibus superioribus brevioribus. Longit.* 18½ *millim., diam.* 11.

Hab. Zomba Plateau, 5000 feet.

This species may prove to be the same as *Hapalus conoideus* of Martens[1], but, judging from the figures, it seems to be longer and narrower, with a more produced and less pointed spire.

32. CURVELLA WHYTEI, sp. nov. (Plate XXXIII. fig. 45.)

Testa elongata, ad apicem obtusa, imperforata, tenuis, pallide straminea, nitida, tenuissime arcuatim striata; anfractus 6–7, convexiusculi, sutura obliqua sejuncti, ultimus elongatus; apertura perpendicularis, inverse auriformis; peristoma tenue, simplex, margine columellari reflexo, appresso, dextro prominente, curvato.

Longit. 12½ *millim., diam.* 4⅓; *apertura* 4⅓ *longa*, 2 *lata.*

Hab. Mount Chiradzulu and Zomba Plateau, 5000 feet.

Martens writes concerning this species:—"Distinct from all my species by its slender form; *C. delicata* the nearest, but also somewhat broader than yours."

33. SUBULINA CHIRADZULUENSIS, sp. nov. (Plate XXXIII. fig. 46.)

Testa elongata, imperforata, pallide cornea, tenuis, subpellucida, lineis incrementi tenuibus obliquis striata, nitida; spira mediocriter acuminata, ad apicem submamillata; anfractus 9, *sensim crescentes, leviter convexi, infra suturam linea angusta pellucida marginati; apertura inverse auriformis, longit. totius ¼ paulo superans; columella arcuata, antice oblique truncata; labrum simplex, tenue.*

Longit. 18 *millim., diam.* 5.

Hab. Mount Chiradzulu.

Allied to *S. subcrenata* Martens. The lines of growth somewhat strong below the suture, producing a subcrenulated appearance. Prof. Dr. E. von Martens (*in litt.*) informs me that

[1] Beschalte Weichthiere Deutsch-Ost-Afrikas, p. 129, pl. v. fig. 14.

it is distinct from all he has described, but comes near his *S. pinguis*, being distinguished by its broader whorls and the different form of the upper part of the spire.

34. Succinea sp. inc.

Hab. Mount Chiradzulu.
One dead specimen.

35. Achatina immaculata Lamarck, var.

Achatina immaculata, Lamarck; Férussac, Hist. Nat. Moll. pl. cxxvii.

Hab. Nyasaland.

None of the specimens hitherto examined are quite like Férussac's figure, in which the aperture is unusually long. The spire also is less conical than in specimens from Cape Delagoa in the British Museum or in the specimens from Nyasaland. The latter have the columella bluish white instead of pinkish, and are of a darker colour, but otherwise are fairly normal. *A. layardi* Pfeiffer is a variety of this species, rather more profusely spotted than the type.

36. Achatina panthera (Férussac). (Plate XXXIV. fig. 1.)

Achatina panthera, Férussac; Reeve, Conch. Icon. fig. 12.

Hab. Zomba.

The specimens from this locality are small and rather slender in comparison with the typical form figured by Férussac (Hist. Nat. Moll. pl. 126). The largest specimen is only 125 millim. in length, although consisting of $8\frac{1}{2}$ whorls, the number possessed by a large typical example from Mozambique 157 millim. long. A very small specimen, which probably would not have grown larger, has a length of only 93 millim.

37. Achatina glutinosa Pfeiffer.

Achatina glutinosa, Pfeiffer, Conch.-Cab. ed. 2, p. 360, pl. xliv. fig. 1.

Achatina petersi, Martens, Novitat. Conch. vol. iii. p. 452, pl. xcix. figs. 13–15.

Hab. Zomba.

I am unable to find any distinguishing characters between this species, said to have been originally obtained in West Africa, and *A. petersi* from Mozambique; and I am of opinion that the locality "W. Africa" is one of the many errors of this kind occurring in Mr. Cuming's collection. The species is remarkably constant in coloration, but varies somewhat in ventricosity. The type is 97 millim. in length and 49 in diameter, whereas a more ventricose specimen is the same length, but 6 millim. broader. A smaller but adult example from Zomba (88 millim. long and 45 wide) is rather more solid than the typical form.

38. Achatina hamillei Petit.

Achatina hamillei, Petit, Journ. de Conch. 1859, p. 384, pl. xiii. fig. 3; Smith, Proc. Zool. Soc. 1881, p. 282, pl. xxxiii. fig. 10.

Hab. Nyasaland (*H. H. Johnston*); Usambara (*Kirk*); Zanzibar, Tanga, &c. (*Martens*).

39. Achatina craveni Smith. (Plate XXXV. figs. 1, 2.)

Achatina kirkii, Smith, Ann. Mag. Nat. Hist. 1880, vol. vi. p. 428 (name preoccupied).

Achatina craveni, Smith, Proc. Zool. Soc. 1881, p. 283, pl. xxxiii. fig. 11; Martens, Weichth. Deutsch-Ost-Afrikas, p. 91.

Hab. Nyika Plateau, 6000–7000 feet, and Malosa, Nyasaland, 6000 feet.

These specimens are rather more coarsely sculptured than the type, and some have the stripes more zigzag than as represented in the cited figure. On the contrary, other specimens are uniformly greenish yellow without any striping at all.

40. Achatina glaucina. (Plate XXXIV. figs. 2, 3.)

Achatina glaucina, Ancey, MSS.

Testa ovato-fusiformis, flavescens vel rufescens, concolor, vel interdum supra spiram strigis rufis obliquis undulatis obscure picta; spira conica, ad apicem obtusa, lateribus convexiusculis; anfractus 8, *lente accrescentes, convexiusculi, superiores tres læves, cæteri granulati, granulis in anfr. ultimo infra medium plus minus obsoletis; apertura glaucina vel cæruleo-albida, in exemplis adultis longit. totius* ½ *haud æquans, inverse auriformis; columella alba, leviter torta, anguste oblique truncata.*

Longit. 66 *millim., diam. maj.* 29; *apertura* 30 *longa,* 16 *lata.*

Hab. Zomba.

A smaller species than *A. johnstoni*, with a less tapering and shorter spire, narrower whorls, and rather finer granulation. The colour varies from uniform greenish yellow to rich brown, but some specimens, chiefly of the latter variety, exhibit reddish striping upon the spire. This kind of ornamentation, however, does not appear to extend to the last volution.

41. Achatina johnstoni, sp. nov. (Plate XXXIV. figs. 4, 5.)

Testa ovato-fusiformis, flavescens, concolor, vel strigis undulatis vel zigzagformibus saturate rufo-castaneis picta; spira elongata, ad apicem obtusa; anfractus 9, *superiores tres læves, convexiusculi, cæteri convexi, incrementi lineis obliquis fortibus striisque spiralibus numerosis ruditer granulati, ultimus infra medium granulis fere evanidis; apertura parva, inverse auriformis, cæruleo-alba, strigis externis translucentibus; columella leviter arcuata vel rectiuscula, infra ad marginem alba, oblique truncata.*

Longit. 79 *millim.*, *diam. maj.* 40; *apertura* 35 *longa*, 19 *lata*.
Hab. Nyasaland.

The principal distinguishing features of this fine species are the prolonged spire, the general form, and coarse granulation. As in some other species, two varieties of coloration occur in the present form. Some are white, clothed with a glossy yellowish epidermis, here and there varied with darker oblique stripes, indicating periods of growth. Other examples, however, are adorned with more or less oblique dark reddish-brown wavy or zigzag-like stripes, which are slender above, becoming broader below. Those on the body-whorl coalesce inferiorly and form a rich brown patch at the base or anterior end. The coarse granulation practically ceases at the periphery, the spiral striæ becoming less pronounced below.

42. Achatina fragilis, sp. nov. (Plate XXXV. figs. 3, 4.)

Testa ovata, supra acuminata, tenuissima, subpellucida, flavo-olivacea, concolor, vel rufo strigata; spira brevis, conica, ad apicem subobtusa; anfractus 6–7, *convexi, superiores* 3 *pallidi, læves, duo sequentes incrementi lineis striis spiralibus decussatis granose sculpti, ultimus magnus, inflatus, infra medium haud granulatus, lineis incrementi obliquis curvatis fortibus ornatus; apertura inverse auriformis, cærulescens, nitens; columella leviter arcuata, tenuis, callo tenuissimo induta, antice anguste truncata; labrum tenuissimum, nigro marginatum.*

Longit. 75 *millim.*, *diam.* 43; *apertura* 47 *longa*, 26 *lata*.
Hab. Nyika Plateau, 6000–7000 feet.

This species is remarkable on account of its extreme thinness and lightness. Some specimens are uniformly yellowish olive, with here and there a darker stripe, marking a period of growth, whilst others, having the same ground-colour, are ornamented with numerous oblique and slightly wavy red stripes. These either extend the whole length of the body-whorl, or occasionally disappear upon the lower half. The somewhat coarse regular granulation ceases a little above the middle, but a few transverse striæ, not sufficient to form a regular granulation of the surface, are traceable below.

43. Cyclophorus (Hijabia) intermedius Martens.

Cyclophorus intermedius, Martens, ¦ Weichth. Deutsch-Ost-Afrikas, p. 8, pl. ii. fig. 3.

Hab. Masuku Plateau, 6000–7000 feet.

Closely allied to *C.* (*Hijabia*) *wahlbergi* Krauss, from Natal, but with the spire rather more elevated.

44. Pomatias nyasanus, sp. nov. (Plate XXXV. fig. 5.)

Testa subglobosa, turbinata, mediocriter umbilicata, pallide rufescens, zona infra peripheriam nigro-purpurea cincta, strigis obscuris arcuatis lividis in anfractu ultimo longitudinaliter picta,

spiraliter undique tenuiter lirata lineisque incrementi tenuissimis sculpta; anfractus 5, *convexi, superiores duo læves, ultimus antice paulo descendens; apertura subcircularis, longit. totius* ½ *superans, intus rufo-fuscescens, zona nigro-purpurea picta, lineis saturate fuscis supra obscure ornata; peristoma albidum, margine dextro vix expanso, columellari subreflexo.*

Diam. maj. 21 *millim., min.* 16, *alt.* 20; *apertura* 10 *longa,* 9 *lata.*

Hab. Mount Chiradzulu; Nyika Range, 7000 feet, and Zomba Plateau, 5000 feet.

Allied to *P.* [*Cyclostoma*] *insularis* Pfeiffer from Natal, but more widely umbilicated, with more convex whorls, more numerous and finer spiral liræ, and without the second purplish-black zone upon the upper part of the body-whorl which revolves up the spire. The outer margin of the aperture also is less expanded.

EXPLANATION OF THE PLATES.

Plate XXXIII.

Figs. 1, 2. *Ennea* (*Gulella*) *vicina*, p. 580.
3, 4. „ „ *varians*, p. 581.
5, 6. *Streptaxis johnstoni*, p. 581.
7, 8. „ *kirki*, p. 582.
9, 10. *Helicarion nyasanus*, p. 582.
11, 12. „ *masukuensis*, p. 582.
13, 14, 15. *Thapsia mixta*, p. 582.
16, 17, 18. „ *insimulans*, p. 583.
19, 20. „ *masukuensis*, p. 583.
21, 22, 23. „ *simulata*, p. 583.
24, 25. „ *nyikana*, p. 584.
26, 27, 28. „ *decepta*, p. 584.
29, 30. *Zingis johnstoni*, p. 584.
31. „ *whytei*, p. 584.
32, 33, 34. *Martensia consociata*, p. 584.
35, 36. *Phasis* (*Trachycystis*) *fusco-cornea*, p. 585.
37, 38. „ „ *fusco-olivacea*, p. 585.
39. *Trochozonites sharpei*, p. 585.
40. *Buliminus* (*Rhachis*) *chiradzuluensis*, p. 586.
41, 42. „ (*Conulinus*) *nyasanus*, p. 586.
43. „ „ *meluloides*, p. 587.
44. *Curvella nyasana*, p. 588.
45. „ *whytei*, p. 588.
46. *Subulina chiradzuluensis*, p. 588.

Plate XXXIV.

Figs. 1. *Achatina panthera*, p. 589.
2, 3. „ *glaucina*, p. 590.
4, 5. „ *johnstoni*, p. 590.

Plate XXXV.

Figs. 1, 2. *Achatina craveni*, p. 590.
3, 4. „ *fragilis*, p. 591.
5. *Pomatias nyasanus*, p. 591.

4. Supplemental Note on the Distribution of Loder's Gazelle and the Dorcas Gazelle in Algeria. By Alfred E. Pease, M.P., F.Z.S.

[Received April 4, 1899.]

I find that a previous paper which I contributed on the Antelopes of Algeria (see P. Z. S. 1896, p. 809) requires correcting in some important particulars, especially in respect of the distribution of the Dorcas and Loder's Gazelle. Before dealing with the question of their distribution I might supplement what I have already written as to the names by which these different species are distinguished by the Arabs. In the North-eastern part of the Algerian Sahara the Dorcas Gazelle (*Gazella dorcas*) is generally known simply by the name "Rhezal" or "Rhezal es sahara," the gazelle of the desert, in contradistinction to "Rhezal el djebel," the gazelle of the mountain (the Admi or Edmi, *G. cuvieri*). In the neighbourhood of the Oued Djedi and Bou Saäda the Dorcas is called "senny," in the Central Sahara it is called "swain." A buck of any species is called "atrous." Till my last journey this year I have always spelt the Arab name for Loder's Gazelle (*G. loderi*) "Rhime," but I think this is not so phonetically correct as Sir Edmund Loder's spelling, "Reem." The Arab word is spelt with the three Arabic letters ra, ia, mim, which reduced to English letters would be "rym" or "rim" and pronounced "reem."

The description of the range of both the Dorcas and Loder's Gazelle requires correcting. In the first place, the Dorcas is not restricted to any such belt of desert as the first 100 miles or so south of the Atlas range. It is to be found on the smaller deserts north of the last ranges of the Atlas. This last winter I saw them and got one specimen from the country south of the Chott el Hodna and north of Bou Saäda, a district known to the French locally as the Little Sahara. I found the Dorcas Gazelle, after crossing the Oued Djedi, all the way to the Mzab, in the Mzab between the Mzab and Ouargla, and south and east of Ouargla. It is to be found in the Central Sahara in the Touareg Country and in the neighbourhood of Ghadamis. Wherever the country is not purely sand-desert, and where immunity from molestation and suitable vegetation allow it to live, it is to be met with; and even in the purely sand-desert south of Tougourt and near the Oued Ighaghar I found it in small bands. In the sand-desert between Ouargla and the Erg, where I expected to find only the Rime, and in the region of the Gantaras between Hassi Tafaya and the Oued Ighaghar, I found it often on the same ground as the Rime (*Gazella loderi*). From my own observation and from the information I picked up from my Chaambi hunter and guides, I feel convinced that though the Dorcas travels often into the sand-desert, the Rime never quits the sand-country for the stony deserts, though I have of course seen the Rime on the

stony Gantaras that crop up out of the sand in this part of the Sahara as well as in the "Dhaias" or "Houaths," or depressions in the desert where the wind has swept the bottom clear of sand. The Rime is found, *generally* speaking, in any part of the Sahara where sand predominates and where there is vegetation and where rain has fallen, though you may travel for days even in parts of this purely sand-dune country or in the Erg without coming across it.

Throughout the Algerian Sahara the Rime is very difficult to approach even where very numerous, much more so than the Dorcas; in my experience, it is shyer, much more easily scared, goes further when disturbed, and is much more on the alert than the Dorcas. This, I think, is largely due to the fact that every Chambi or Arab of the south carries a gun and many of them have greyhounds (the Sloughi); many are professional hunters for meat to supply the markets of El Oued, Ouargla, Ghadamis, and other towns. I have during the past few weeks seen many hundreds of Rime and have only secured four specimens, only once having obtained a shot at less than 400 yards. I devoted six days to hunting them from two camps and only got two, the only two chances I had, excluding a long galloping shot from the shoulder. In this district the Rime appeared to avoid the dunes where approach would have been possible, and kept to the bare level plateaux of the Gantaras [1] or the plains of the Dhaias.

Further south, in the Erg and in the waterless region between Aïn Taïba and Ghadamis, the Rime is less sophisticated, and my Chaambi hunter told me that he had hunted in this country at places where water is 20 days apart and had been able to kill many Rimes. On one occasion he and two other professional hunters were 50 days hunting, and killed 90 Rimes and 7 Addaxes, returning from time to time to Ghadamis to dispose of the meat. I may remark that it appears to me that the meat being putrid makes little difference in its saleable value. I have seen camel-loads of stinking Gazelle- and Addax-meat brought into Ouargla market and sold by auction to crowds of eager buyers.

Only men accustomed to the country and able to bear the fatigue of long days of fast travelling on Mehara, and indifferent to thirst and the severe labour of hunting in deep sand, could succeed in the places these men frequent.

The nearest point to Ouargla where Addax have been killed this year (1899) has been 3 days south of Aïn Taïba.

[1] Gantara or Kantara in Arabic literally means a bridge, and is a term used by the Arabs to describe the ridges and plateaux of rock (? or gypsum) that crop up in the sand-desert: as a rule the Gantaras are ridges banked by sand hills running parallel with the Oueds or surrounding the Houaths.

5. On the Dates of the 'Encyclopédie Méthodique': Additional Note. By C. Davies Sherborn and B. B. Woodward.

[Received March 27, 1899.]

To the 'Proceedings' of this Society, 1893, pp. 582–584, we contributed a note on the dates of this book: information has now come to hand which enables us to correct some doubtful points and to complete the information.

T. VIII. part 2, Insectes (livraison 77 of the Encyclopédie), was published in July **1812**, not [?**1814**]. Pp. 1–45 of T. VIII. pt. 1 was written by B. E. Manuel.

T. IX. part 2, Insectes (livr. 95), was published in July **1824**. Of this part 2, pp. 329–706, 708–711 were by Godart; pp. 706, 707 and all extra-European Hesperides were by Latreille, to p. 793; from *Castnia* to end by Godart.

T. X. Insectes, came out in two parts as follows:—

Pt. 1, pp. 1–344. **1825** (livr. 96).
Pt. 2, pp. 345–832. **1828** (livr. 100).

Hist. Nat. des Zoophytes, by Lamouroux, Bory, and Eudes-Deslongchamps:

Pt. 1. pp. 1–376. **1824** (livr. 95).
pp. 377–819. Oct. **1827** (livr. 98).

Hist. Nat des Vers:

T. II. pt. 2 was published along with Vol. III. in Sept. **1832** (not **1831**).

May 16, 1899.

W. T. Blanford, Esq., LL.D., F.R.S., V.P., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of April 1899:—

The total number of registered additions to the Society's Menagerie during the month of April was 87, of which 20 were by presentation, 6 by birth, 35 by purchase, and 26 were received on deposit. The total number of departures during the same period, by death and removals, was 87.

Amongst the additions the following are worthy of special notice:—

A young male Giraffe, believed to be about eleven months old, purchased of Mr. C. Reiche, of Alfeld, on April 1st. This Giraffe belongs to the Southern form, *Giraffa camelopardalis capensis* (*cf.* P. Z. S. 1897, p. 277), and was obtained by Mr. Reiche's agents in the Transvaal, probably from the adjacent district of Portuguese East Africa.

Four Masked Hawfinches (*Coccothraustes personatus*) from Japan, purchased April 7th, new to the Society's Collection.

Three female Ostriches of the Northern form (*Struthio camelus*), presented April 25th by G. Fanshawe Abadie, Esq., by whom they were brought home from the Niger. Mr. Abadie kindly informs me that these Ostriches were obtained from Sokoto, but were stated to have been captured in a district adjoining the eastern shores of Lake Tchad.

The Secretary read extracts from letters addressed to him by Mr. J. S. Budgett, F.Z.S., on the Society's Scientific Mission to the Gambia Colony. They were dated from M'Carthy's Island, March 22nd and April 18th last. The natives reported that as soon as the rains began on the upper river and the water to rise, the creeks and swamps would be flooded and pregnant *Polypteri* would enter them in swarms. Lung-fishes (*Protopterus*) would be found at this period of the year in similar situations. So far Mr. Budgett had only seen examples of two species of Antelope, which he believed to be a Gazelle and a Bushbok (*Tragelaphus scriptus*). Mr. Budgett had made various short excursions to Demfai, on the boundary of the British and French territories, and Alimaka in Kunchan Creek. At the latter place he had been very successful in fishing and had obtained examples of a very curious Mormyrid, with a cylindrical whip-like caudal appendage.

Mr. Budgett felt quite confident that he would obtain examples of the early stages of development of *Polypterus* by the end of June, and hoped to be at home in July. The unhealthy season did not begin till August.

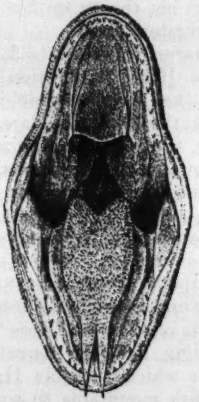
Mr. G. A. Boulenger exhibited a specimen of the Bornean Lizard *Lanthanotus borneensis*, belonging to the Sarawak Museum, for the loan of which he was indebted to the kindness of H. H. the Rajah of Sarawak.

Mr. Boulenger pointed out that, since the description of this curious type of Lizards by Steindachner in 1878, no second specimen was known to have reached Europe, and that, owing to the fact that the original description had been confined to the external characters, the exact systematic position of *Lanthanotus* had not been ascertained. The original describer had proposed to regard the genus as the type of a distinct family, *Lanthanotidæ*, near the *Helodermatidæ*, whilst the author of the 'Catalogue of Lizards' had placed it provisionally under the latter family.

By means of the Röntgen rays, thanks to the kind assistance of Messrs. Gardiner & Green, the principal osteological characters had been ascertained without cutting into the specimen now exhibited, with the result that the affinity of *Lanthanotus* to the *Helodermatidæ* was fully confirmed. The structure of the skull, characterized by the presence of a postorbital arch combined with

the absence of a postfronto-squamosal arch, the slender clavicles, the absence of transverse processes to the interclavicle, together with the character of the tongue, settled the question beyond dispute. The sciagraph further revealed the fusion of the premaxillaries and of the parietals, which are devoid of a pineal foramen, the distinctness of the nasals and of the frontals, the presence of a small supratemporal, and the absence of a squamosal. The vertebræ numbered 103: 8 cervical, 26 dorsal, 1 lumbar, 2 sacral, 66 caudal. The first three dorsal vertebræ bore sternal ribs, as in *Varanus*, *Heloderma* having 4 sternal ribs. The phalanges, in both manus and pes, numbered 2, 3, 4, 4, 3; there was thus one phalanx less in the fourth digit and in the fifth toe than in *Heloderma* and *Varanus*.

The resemblance of the open mouth of *Lanthanotus*, as shown in the accompanying figure, to that of *Heloderma* was extremely



Open mouth of *Lanthanotus borneensis*.

striking. The teeth were similar in both genera, but they showed no traces of grooves in *Lanthanotus*. There were 7 teeth in the præmaxillary bone, 12 in each maxillary, 12 in each ramus of the mandible. The palate was toothed as in *Heloderma*: one tooth on the palatine bone, four on the pterygoid. The tubercles on the head and body were devoid of ossifications. The lower eyelid was entirely occupied by a single semitransparent shield.

The specimen in the Sarawak Museum, a male, obtained in the Rejang River District in 1891 by the Hon. C. A. Bampfylde, was a little smaller than the type in the Vienna Museum. It had a total length of 310 millim., in which the head entered for 22 and the tail for 160; fore limb 30, hind limb 38.

Mr. G. E. H. Barrett-Hamilton, F.Z.S., exhibited a skin of the Varying Hare (*Lepus variabilis*) from Nairn, Scotland, for which he was indebted to the courtesy of the Earl of Cawdor. The skin was in the interesting moulting-stage of spring, and clearly showed that the darker colour of summer was due to the casting off of the white hairs of winter and their replacement by a new set of hairs of the dark summer colour. Mr. Barrett-Hamilton was therefore glad to be able to corroborate the observations of Mr. J. A. Allen[1] on the American White Hare (*Lepus americanus* Erxl.), at least so far as concerned the spring change of colour. Mr. Allen's paper had been written partly with a view to combat the view, which once widely held, that the change of colour in the Varying Hare was due, at least in part, to an actual change of the pigment of the hairs, which theory had been advocated in an elaborate paper by Assistant-Surgeon F. H. Welch[2], and had been largely utilized by no less an authority than Mr. E. B. Poulton as the chief basis for his theory on the "Variable Protective Resemblances in Vertebrates"[3].

Another point of interest was the late date at which the spring moult takes place (the Hare in question was received early in May). The date of the spring moult in the more southern countries inhabited by the Variable Hare, such as the South of Ireland, was no earlier, so that the spring change at all events was apparently unaffected by climatic conditions, although in the south the amount of whiteness assumed was very much less than in the north.

The whole seasonal change in fact seemed to be normally quite out of control of the animal, and also, it seemed, not subject to the direct influence of the weather (at least not to such changes of temperature as might be experienced in different parts of the British Isles), the experiments of Captain Ross[4] on a Hudson's Bay Lemming notwithstanding; and Mr. Barrett-Hamilton was aware of several instances in which Variable Hares transported from Scotland and from Irish mountains to southern and low-lying regions continued for some seasons to appear in their northern garb of snowy whiteness. This persistence of the habit of turning white, even in unsuitable conditions, together with the lateness of the moult, resulted frequently in the curious spectacle of a mountain Hare running about in all its conspicuous arctic livery under the bright rays of an April or May sun. After a few years such imported Hares, or more probably their offspring, ceased to turn completely white, and the breed assumed the appearance of the ordinary Hares of the southern locality to which they had been transported. The persistence of this change even under unsuitable conditions, together with the lateness of the spring moult (owing to

[1] "On the Seasonal Change of Colour in the Varying Hare (*Lepus americanus* Erxl.)." Bull. Amer. Mus. Nat. Hist. vol. vi. art. iv. pp. 107–128, May 7, 1894.

[2] P. Z. S., 1869, pp. 228–236.

[3] See 'The Colours of Animals,' chap. vii. Intern. Sci. Ser. vol. lxvii. 1890.

[4] See Appendix to Second Voyage, p. xiv (1835), and 'Bell's British Quadrupeds,' ed. i. p. 199 (1874).

which an animal that had turned white in southern regions was during the spring a very conspicuous object), and the occasional turning white of individuals in southern regions where the white-turning habit had long since been dropped by the majority of the species, was, especially among Stoats, in Mr. Barrett-Hamilton's opinion, the cause of the numerous reported instances[1] of the assumption of white in mild winters in England. Both these phenomena, *i. e.* the late moult and the tendency of solitary individuals of non-white-turning races to revert to the white-turning habit, were, at first sight, of apparently little use, or perhaps even dangerous to the species in question. On further consideration, however, it appeared that their utility was probably to be found in the opportunity afforded by their means of adaptation to changed climatic conditions; it being obvious that, in countries where an animal, if it turned white in winter, would have to go about in that conspicuous garb for some time after the disappearance of all snow and frost, those individuals which turned less white than their companions would have a better chance of surviving, and so would become (as is the case in southern countries) the dominant feature of the race; whereas the occasional individual reappearance of the white-turning habit gave an opportunity to the species for its general reassumption, should climatic conditions become more severe.

Mr. Allen had pointed out that in *Lepus americanus* the spring moult "occurs quite as early and proceeds just as rapidly (if not a little more so) in the females as in the males, and that the moult is practically completed before the young are born" (*op. cit.* p. 122); but Mr. Barrett-Hamilton stated that the latter part of this statement was not true for the south of Ireland, where the Variable Hare was still in winter-coat in early May, whereas its young were usually born at a very much earlier date, the exact date of their birth depending almost entirely on the weather.

Mr. E. M. Corner read a note on the variations of the patella in the Divers, Grebes, and Cormorants, by which, as he believed, the functions of the bones in these birds might be explained.

A communication was read from Marquis Ivrea on the Wild Goats of the Ægean Islands. A series of heads and some photographs of the Goats of the islands of Antimilo and Joura were exhibited, with the object of showing that the effect of a cross between *Capra ægagrus* and *C. hircus* (such as had been proved to have occurred on the former island) was not to produce an animal corresponding to *C. dorcas* (Reichenow), and that consequently the Goat of Joura had not, as was generally assumed, been so produced, but was, as a matter of fact, a local variety of the Wild Goat, for which the name *C. ægagrus*, var. *jourensis*, was suggested.

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[1] See various communications to the 'Field.'

Mr. G. A. Boulenger, F.R.S., read an account of the Fishes obtained by the Congo Free State Expedition, under Lieutenant Lemaire, in Lake Tanganyika, in 1898. Ten new species were described, of which three were made the types of new genera.

This paper will be printed in full in the Society's 'Transactions.'

The following papers were read :—

1. Notes on a Second Collection of Reptiles made in the Malay Peninsula and Siam, from November 1896 to September 1898, with a List of the Species recorded from those Countries.

By Stanley Smyth Flower, F.Z.S., 5th Fusiliers.

[Received April 14, 1899.]

(Plates XXXVI. & XXXVII.)

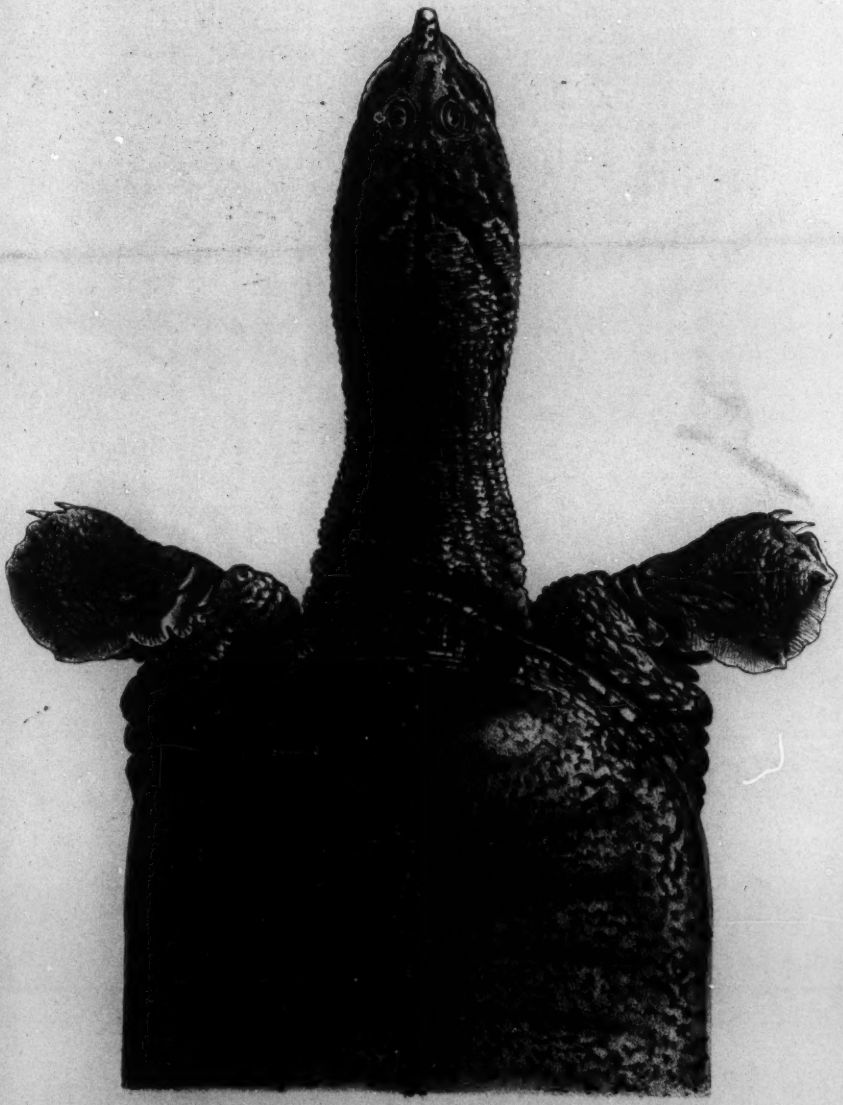
Page
Part I. Introductory 600
„ II. Table of Species, showing the Relationship of the known Fauna of the Peninsula and Siam to that of the neighbouring Countries 602
„ III. List of Species, with Remarks on their Localities, Habits, Life-coloration, &c. 609

Part I.—Introductory.

Malay Peninsula Reptiles.—In the Proceedings of this Society for 1896, pp. 856–914, there appeared a paper giving an account of the Reptiles and Batrachians that I had collected in the Malay Peninsula from March 1895 to April 1896, and a list of the species recorded from that neighbourhood by Cantor, Stoliczka, and others. That list included 176 species of Reptiles, of which 9, viz., *Dermochelys coriacea*, *Hardella thurgi*, *Cyclemys dhor*, *Tropidonotus subminiatus*, *Macrocalamus lateralis*, *Hypsirhina indica*, *Hydrophis nigrocinctus*, *Aipysurus edyouxi*, and *Amblycephalus lævis* were of doubtful occurrence in the region. In the present list 3 of the doubtful species are recorded for certain, viz., *Dermochelys coriacea*, *Macrocalamus lateralis*, and *Aipysurus eydouxi*; 9 more species are added, viz., *Geoemyda grandis*, *Testudo elongata*, *Gymnodactylus marmoratus*, *Mabuia rugifera*, *Lygosoma maculatum*, *Zaocys fuscus*, *Coluber tæniurus*, *Hypsirhina bocourtii*, and *Hydrophis gracilis*; *Gonatodes penangensis* becomes a synonym of *G. affinis*; and the names of *Hemidactylus gleadovii* and *Lygosoma jerdonianum* are changed to *H. brookii* and *L. atrocostatum* respectively: thus making a total of 184 species.

Only one genus, *Macrocalamus*, is peculiar to the Peninsula, and 6 species, viz., *Gonatodes affinis*, *Lygosoma singaporense*, *Cylindrophis lineatus*, *Macrocalamus lateralis*, *Calamaria albiventer*, and *Hypsirhina indica*.

Siamese Reptiles.—So far as I am aware, only one paper has yet



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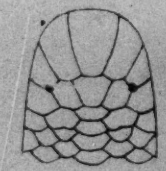

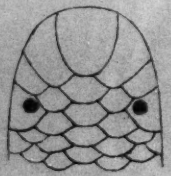

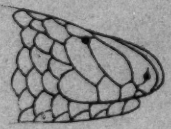

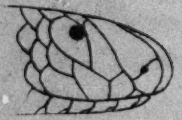

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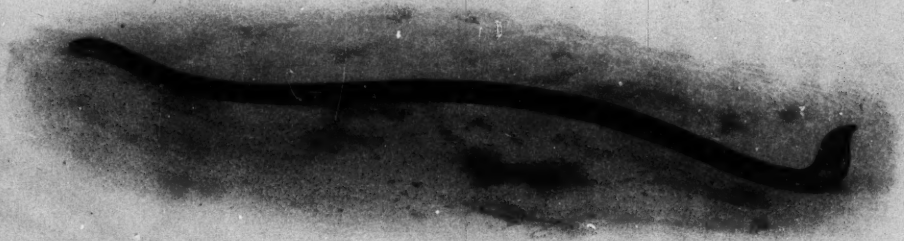

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1.TYPHLOPS ALBICEPS. 2.TYPHLOPS FLOWERI. 3.CYLINDROPHIS RUFUS.

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appeared giving a list of the Reptiles of Siam[1], most of our knowledge of which is from the collections made by M. Mouhot forty years ago; so we have to turn to that invaluable work, Mr. Boulenger's 'Catalogue of the Reptiles' in the British Museum to get an idea of our present knowledge of the herpetological fauna of the country, and in the seven volumes we find 85 species mentioned, to which 21 more can now be added, viz., *Batagur* sp. inc., *Chelone mydas*, *Chelone imbricata*, *Thalassochelys caretta*, *Pelochelys cantoris*, *Phyllodactylus siamensis*, *Gehyra mutilata*, *Draco volans*, *Calotes microlepis*, *Calotes emma*, *Lygosoma maculatum*, *Lygosoma melanostictum*, *Lygosoma bowringii*, *Typhlops albiceps*, *Typhlops floweri*, *Acrochordus javanicus*, *Cöluber radiatus*, *Dipsadomorphus dendrophilus*, *Hydrophis obscurus*, *Enhydris hardwickii*, and *Doliophis bivirgatus*: thus making a total of 106 species.

Only one genus, *Prymnomiodon*, is peculiar to Siam, and 13 species, viz., *Phyllodactylus siamensis*, *Acanthosaura capra*, *Acanthosaura coronata*, *Physignathus mentager*, *Mabuia longicaudata*, *Typhlops siamensis*, *Typhlops schneideri*, *Typhlops albiceps*, *Typhlops floweri*, *Prymnomiodon chalceus*, *Lycodon laoensis*, *Hypsirhina jagorii*, and *Amblycephalus margaritophorus*.

Boundary.—It is impossible to divide the fauna of Siam from that of the Malay Peninsula, as the northern part of the Malay Peninsula forms what is known as "Lower Siam." Zoologically so little is known of this tract of country that we cannot say where the fauna of Siam (*i. e.* the neighbourhood of Bangkok and the Menam Valley) stops and that of British Malaya commences, or whether the two gradually merge into each other, as seems probable.

Imperfection of present knowledge.—Although Günther in 1864 (Reptiles Brit. Ind. p. ix) wrote of the Malayan Peninsula and Siam, "this belt of land is well explored," and Stoliczka in 1873 (Journal Asiatic Soc. Bengal, vol. xlii. ii. p. 112) wrote: "The present list, in connection with that of Drs. Cantor, Gray, and Günther, and my own published in 1870, may be considered as fairly completing the number of reptiles and amphibians inhabiting Penang and the neighbouring Wellesley Province," I venture to think that a very great deal remains to be done in this part of the world; no one has yet collected over the greater part of the area of either the Malay Peninsula or Siam, and particularly the fauna of the many mountain-ranges requires investigation.

The great variety of Tortoises, 23 species, inhabiting this region is remarkable, and the curious local distribution of species with practically similar habits, when fully worked out, might give very interesting results.

The natural distribution of the Malayan Geckoes it is almost too late to be able to trace: certain species apparently are yearly extending their area, unconsciously taking advantage of and following the march of civilization, while other species, less

[1] Günther, "On the Reptiles of Siam," P. Z. S. 1860, pp. 113–117.

Part II.

TABLE OF SPECIES, *showing the Relationship of the known Fauna of the Malay Peninsula and Siam to that of neighbouring Countries.*

Consecutive Number.	Nominal List of Species of Reptiles known to occur in Siam or the Malay Peninsula.	Other Countries to the Westward.	India.	Ceylon.	Burma.	Nicobars.	Andamans.	China.	Annam.	Cochinchina.	Cambodia.	Siam (proper).	Lower Siam.	Malay Peninsula.	Sumatra.	Islands round Sumatra.	Java.	Natunas.	Borneo.	Celebes.	Philippines.	Lesser Sunda Is.	Moluccas.	New Guinea.	Australia.	Other Countries to the Eastward.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	Dermochelys coriacea (*L.*)	Atlantic Ocean.	...	...	+		...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	Pacific Ocean.
2	Platysternum megacephalum *Gray*	.....	...	...	+	...	...	+	...	...	...	+	...	+	...	...	...	...	...	...	...	...	...	...	...	
3	Callagur picta *Gray*	.....	...	...	...	...	...	...	...	...	...	?	...	+	...	...	...	..	+							
4	Batagur baska *Gray*	.....	+	...	+	...	...	...	...	...	...	...	...	+	...											
5	Hardella thurgi *Gray*	.....	+	...	...	...	...	...	...	...	...	...	...	?												
6	Damonia subtrijuga (*Schleg. & Müll.*)	....	...	...	...	...	...	...	...	...	+	+	...	...	...	...	+									
7	Bellia crassicollis (*Gray*)	.....	...	...	+	...	...	...	...	...	...	+	+	+	...	...	...	...	+							
8	Cyclemys platynota *Gray*	.....	...	...	+	...	...	...	...	...	...	...	...	+	...	...	...	...	+							
9	„ dhor (*Gray*)	.....	+	...	+	...	...	...	...	...	+	...	+	+	...	+	+	...	+							
10	„ mouhotii *Gray*	.....	...	...	Cachar	...	...	...	...	+	...	+	...	...	...	...	...	...	+							
11	„ amboinensis (*Daud.*)	.....	...	...	+	...	...	...	...	...	...	+	+	+	+	...	...	...	+	+	+	...	+			
12	Geoemyda spinosa *Gray*	.....	...	...	+	...	...	...	...	...	...	+	...	+	...	...	...	...	+							
13	„ grandis *Gray*	.....	...	...	+	...	...	...	...	...	+	+	+	+	...	...	...	...	+							
14	Testudo emys *Schleg & Müll.*	.....	...	...	+	...	...	...	...	...	+	+	...	+	+	...	...	...	+							
15	„ elongata *Blyth*	.....	+	...	+	...	...	...	...	+	+	+	...	+												
16	Chelone mydas (*L.*)	Atlantic Ocean.	+	+	...	...	...	+	...	...	...	+	...	+	...	...	...	...	...	...	...	.	..	...	+	Pacific Ocean.
17	„ imbricata (*L.*)	Atlantic Ocean.	+	+	...	...	...	+	...	...	...	+	...	+	...	...	...	...	...	...	...	...	...	...	+	Pacific Ocean.
18	Thalassochelys caretta (*L.*)	Atlantic Ocean.	+	+	...	...	...	...	...	...	...	+	...	+	...	...	...	...	...	+	...	...	+	...	...	Pacific Ocean.
19	Trionyx subplanus *Geoffr.*	.....	...	...	+	...	...	...	...	...	...	...	...	+	+	...	+	...	+	+	+	...	...	...	+	Pacific Ocean.
20	„ hurum *Gray*	.....	+	...	...	...	...	...	...	...	...	...	...	+												
21	„ phayrii *Theob.*	.....	...	...	+	...	...	...	...	...	...	...	...	+	...	...	+	...	+							
22	„ cartilagineus (*Bodd.*)	.....	...	...	+	...	...	...	...	...	+	+	...	+	+	...	+	...	+							
23	Pelochelys cantoris *Gray*	.....	+	...	+	...	...	+	...	...	...	+	+	+	...	...	+	...	+		+					
24	Tomistoma schlegeli (*S. Müll.*)	.....	...	...	...	...	...	...	...	...	+	+	...	+	...	...	+	...	+	...	...					
25	Crocodilus siamensis *Schneid.*	.....	...	...	...	...	...	...	...	...	+	+	...	+	...	...	+	...	+							
26	„ porosus *Schneid.*	.....	+	+	+	...	...	+	...	...	+	+	+	+	+	...	+	...	+	+	+	+	...	+	+	Fiji, Solomon Is.
27	„ palustris *Leeson*	Baluchistan.	+	+	+	...	...	...	...	...	...	...	...	+												
28	Gymnodactylus marmoratus (*Kuhl*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	...	+	...	+							
29	„ palchellus (*Gray*)	.....	?	...	+	...	...	...	...	...	...	...	...	+												
30	Gonatodes kendalli (*Gray*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	+							

31	Gonatodes affinis (*Stol.*)	.....	...	...	...	...	...	...	...	...	...	...	...	+															
32	Æluroscalabotes felinus (*Gthr.*)	.....	...	..	...	...	...	...	...	...	...	...	...	+	...	...	...	...	+										
33	Phyllodactylus siamensis *Blgr.*	.....	..	...	...	...	...	...	...	...	...	+																	
34	Hemidactylus frenatus (*Schleg.*)	St. Helena, Somali, Mauritius.	+	+	+	...	+	+	...	...	+	+	+	+	...	+	+	..	+	+	+	+	...	...	+				
35	,, brookii *Gray*	Tropical Africa	+	+	+	...	...	+	...	...	...	...	...	+	...	...	...	...	+	...	...	+								
36	,, depressus *Gray*	.....	...	+	...	...	...	...	...	...	...	...	...	+															
37	,, leschenaulti *D. & B.*	.....	+	+	...	...	...	...	...	...	...	...	...	+															
38	,, coctæi *D. & B.*	.....	+	...	...	...	...	...	...	...	...	...	...	+															
39	,, platyurus (*Schneid.*)	.....	+	+	+	...	...	+	...	...	+	+	...	+	...	...	+	...	+	+	+	+							
40	Mimetozoon craspedotus (*Mocq.*)	.....	...	...	...	...	...	...	...	...	...	...	...	+															
41	Gehyra mutilata (*Wiegm.*)	Seychelles, Mascaren: Is.	...	+	+	...	...	...	...	...	...	+	+	+	+	...	...	...	+	+	+	+	...	+	...	Western Mexico.			
42	Lepidodactylus ceylonensis *Blgr.*	.....	...	+	+	...	...	...	...	...	...	...	...	+	...	+	+	...	+										
43	,, lugubris (*D. & B.*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	...	Bintang	...	...	...	+	...	...	+	+	...	Polynesia.			
44	Gecko verticillatus (*Laur.*)	.....	+	...	+	...	...	+	+	...	...	+	...	+	...	...	+	...	...	+	+	+								
45	,, stentor (*Cant.*)	.....	...	...	+	...	+	...	...	...	...	.	...	+	+	...	+	...	+										
46	,, monarchus (*Schleg.*)	.....	...	+	...	...	...	...	...	...	...	...	...	+	+	+	...	...	+	+	+	...	+						
47	Ptychozoon homalocephalum (*Crev.*)	.....	...	...	+	...	...	...	...	...	...	...	...	+															
48	,, horsfieldi (*Gray*)	.....	...	...	...	...	...	...	...	...	...	...	...	+															
49	Draco volans *L.*	.....	...	...	...	...	...	...	...	...	...	...	+	+	+	+	+	...	+										
50	,, maculatus *Cantor*	.....	...	...	+	...	...	...	Pulo Condor	+	+	...	+																
51	,, fimbristus *Kuhl*	.....	...	...	...	...	...	...	...	...	...	...	+	+	...	...	+	...	+										
52	,, quinquefasciatus *Gray*	.....	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	+											
53	,, tæniopterus *Gthr.*	.....	...	...	+	...	...	...	...	...	+																		
54	,, melanopogon *Blgr*	.....	...	...	...	...	...	...	...	...	...	...	+	...	...	...	+	+											
55	Aphaniotis fusca *Peters*	.....	...	...	...	...	...	...	...	...	...	...	+	...	...	...	+	+											
56	Gonyocephalus herveyi *Blgr*	.....	...	...	...	...	...	...	...	...	...	...	+	...	...	...	+												
57	,, borneensis (*Schleg.*)	.....	...	...	...	...	...	...	...	...	...	...	+	...	...	...	+												
58	,, grandis (*Gray*)	.....	...	...	+	...	...	...	...	...	...	...	+	+	+	...	...	+											
59	Acanthosaura capra *Gthr.*	.....	...	...	...	...	...	...	...	...	+																		
60	,, armata *Gray*	.....	...	...	+	...	...	...	+	...	+	...	+																
61	,, coronata *Gthr.*	.....	...	...	...	...	...	...	...	...	+																		
62	Calotes cristatellus (*Kuhl*)	.....	...	...	+	...	...	...	...	...	...	+	+	+	+	+	...	+	+	+	Timor Laut.	+							
63	,, microlepis *Blgr*	.....	...	...	+	...	...	...	...	...	+																		
64	,, versicolor (*Daud.*)	Afghanistan, Baluchistan.	+	+	+	...	...	+	...	...	+	+	+																
65	,, emma *Gray*	.....	...	...	+	...	...	...	...	...	+																		
66	,, mystaceus *D. & B.*	.....	...	+	+	+	..	...	...	...	+	+																	
67	Physignathus mentager *Gthr.*	.....	...	...	...	...	...	...	...	...	...	+																	
68	Liolepis belli (*Gray*)	.....	+	...	+	...	...	+	...	...	+	+	...	+															
69	Varanus flavescens (*Gray*)	.....	+	...	+	...	...	..	..	..	...	...	...	+															
70	,, nebulosus (*Gray*	.....	+	...	+	...	...	...	...	...	...	+	...	+															
71	,, rudicollis *Gray*	.....	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	+	...	+								
72	,, salvator (*Laur.*)	.....	+	+	+	...	...	...	...	...	...	+	+	+	...	...	+	...	+	+	+	+	...	...	+				

TABLE OF SPECIES (*continued*).

Consecutive Number.	Nominal List of Species of Reptiles known to occur in Siam or the Malay Peninsula.	Other Countries to the Westward.	India.	Ceylon.	Burma.	Nicobars.	Andamans.	China.	Annam.	Cochinchina.	Cambodia.	Siam (proper).	Lower Siam.	Malay Peninsula.	Sumatra.	Islands round Sumatra.	Java.	Natunas.	Borneo.	Celebes.	Philippines.	Lesser Sunda Is.	Moluccas.	New Guinea.	Australia.	Other Countries to the Eastward.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
73	Mabuia novemcarinata (*And.*)	.....	...	...	+	...	...	...	...	...	...	...	...	+												
74	,, macularia (*Blyth*)	.....	+	...	+	...	...	...	...	...	+	+	...													
75	,, rugifera (*Stol.*)	.....	...	...	...	+	...	...	...	...	...	+	...	+	...	+	+	...	+							
76	,, multifasciata (*Kuhl*)	.....	?	...	+	...	...	...	...	...	...	+	+	+	...	+	+	...	+	+	+	+	+			
77	,, siamensis (*Gthr.*)	.....	...	...	...	...	...	+	...	...	...	+														
78	,, longicaudata (*Hallow.*)	.....	...	...	...	...	...	...	...	...	...	+														
79	Lygosoma anomalopus *Blgr.*	.....	...	...	..	...	...	...	...	...	...	+	...	+	+											
80	,, maculatum (*Blyth*)	.....	+	...	+	...	+	...	...	...	...	+	...	+												
81	,, olivaceum (*Gray*)	.....	...	...	+	+	...	...	...	...	...	...	...	+	+	...	+	...	+	...	+					
82	,, atrocostatum (*Lesson*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	...	...	+	...	...	+	+	...	+	+	+	Caroline & Santa Cruz Islands.
83	,, singaporense (*Staud.*)	.....	...	...	...	...	...	...	...	...	...	...	...	+												
84	,, melanostictum *Blgr.*	.....	...	...	+	...	...	...	...	...	...	+														
85	,, bowringii (*Gthr.*)	.....	...	...	+	...	...	+	...	...	...	+	...	+	...	...	...	...	+	+						
86	,, albopunctatum (*Gray*)	.....	+	...	+	...	...	...	...	...	...	...	...	+												
87	,, chalcides (*L.*)	.....	...	...	...	...	...	+	...	...	...	+	...	+												
88	Typhlops lineatus *Boie*	.....	...	...	...	...	...	...	...	...	...	...	...	+	?	...										
89	,, braminus (*Daud.*)	Africa, Madagascar, Arabia.	+	+	+	...	...	+	...	...	...	+	...	+	...	...	+	...	+	+	+					
90	,, bothriorhynchus *Gthr.*	.....	+	...	...	...	...	...	...	...	...	...	...	+												
91	,, siamensis *Gthr.*	.....	...	...	...	...	...	...	...	...	...	+														
92	,, nigroalbus *D. & B.*	.....	...	..	...	...	...	...	...	...	...	...	...	+	+											
93	,, schneideri *Jan.*	.....	...	...	...	...	...	...	...	...	...	+														
94	,, albiceps *Blgr.*	.....	...	...	...	...	...	...	...	...	...	+														
95	,, floweri *Blgr.*	.....	...	...	...	...	...	...	...	...	...	+														
96	Python reticulatus (*Schneid.*)	.....	...	...	+	...	...	...	...	...	...	+	...	+	+	+	+	+	+	+	+	+	+			
97	,, molurus (*L.*)	.....	+	+	...	...	...	+	...	...	...	...	...	+	...	...	+	...	...							
98	,, curtus *Schleg.*	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	...	...	...	+							
99	Cylindrophis rufus (*Laur.*)	.....	...	...	+	...	...	...	...	...	+	+	...	+	+	...	+	...	+	+						
100	,, lineatus *Blanf.*	.....	...	...	...	...	...	...	...	...	...	...	...	+												
101	Xenopeltis unicolor *Reinw.*	.....	+	...	+	...	...	...	...	...	...	+	...	+	+	+	+	...	+	+						
102	Acrochordus javanicus *Hornst.*	.....	...	...	...	...	...	...	...	...	...	+	...	+	...	...	+	...	...	...	...	...	...	+		
103	Chersydrus granulatus (*Schneid.*)	.....	+	+	+	...	...	...	...	...	...	+	...	+	+	...	+	...	+	+	+	...	...	+		
104	Xenodermus javanicus *Reinh.*	.....	...	...	...	...	...	...	...	...	...	+	...	+	+	...	+									
105	Polyodontophis geminatus (*Boie*)	.....	...	...	...	...	...	...	...	...	...	+	...	+	+	...	+	...	+	...	...	+				
106	,, sagittarius (*Cant.*)	.....	+	...	Assam	...	...	...	...	...	...	...	...	+												
107	Xenochrophis cerasogaster (*Cant.*)	.....	+	...	Assam	...	...	...	...	...	...	...	...	+												
108	Prymnomiodon chalceus *Cope*	.....	...	...	...	...	...	...	...	...	...	+														
109	Tropidonotus trianguligerus *Boie*	.....	...	...	+	...	...	...	...	...	...	...	...	+	+	+	+	...	+	+	...	...	+			

110	Tropidonotus piscator (*Schneid.*)...	.....	+	...	+	...	...	+	...	...	+	+	+	+	...	...	+	...	...	...	...	...	...	...	...	...	Manchuria, Japan.
111	,, tigrinus *Boie*	.....	...	...	...	...	...	+	...	+	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
112	,, stolatus (*L.*)	.....	+	+	+	...	...	+	...	...	...	...	...	+	...	...	+	...	...	...	+	...	...	...	...	...	
113	,, vittatus (*L.*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	...	...	+	...	...	...	...	...	+	...	...	...	
114	,, subminiatus *Schleg.*.	.....	+	...	+	...	...	+	...	...	+	+	...	+	...	...	+	...	+	...	+	...	...	...	...	...	
115	,, chrysargus *Schleg.*...	.....	+	...	+	...	...	+	...	...	...	...	...	+	+	+	+	...	+	...	...	...	...	...	...	...	
116	,, maculatus *Edeling*...	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	...	...	...	+	...	...	...	...	...	...	...	
117	Macropisthodon flaviceps (*D. & B.*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	...	...	...	+	...	+	...	...	...	...	...	
118	,, rhodomelas (*Boie*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	...	+	...	+	...	...	...	...	...	...	...	
119	Helicops schistosus (*Daud.*).....	.....	+	+	+	...	...	Yunnan	...	...	...	...	...	+													
120	Lycodon aulicus (*L.*)	Mascarene Is.	+	+	+	...	...	...	...	+	+	+	+	+	+	...	+	...	...	+	+	+					
121	,, laoensis *Gthr.*	.....	...	...	...	...	...	...	...	...	..	+															
122	,, effrenis *Cant.*	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	...	...	...	+								
123	,, subcinctus *Boie*	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	+	+	...	+	...	+	+					
124	Dryocalamus subannulatus (*D. & B.*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	+												
125	,, davisonii (*Blanf.*) ...	.....	...	...	+	...	..	...	+	+	...	+															
126	Zaocys carinatus (*Gthr.*)	.....	...	...	...	...	.	...	...	...	...	...	...	+	+	...	...	...	+								
127	,, fuscus (*Gthr.*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	...	...	+	+								
128	Zamenis korros (*Schleg.*)	.....	+	...	+	...	...	+	...	...	...	+	...	+	+	...	+										
129	,, mucosus (*L.*)	Transcaspia, Afganistan.	+	+	+	...	...	+	...	...	...	+	...	+	...	...	+										
130	,, spinalis (*Peters*)	.....	...	...	...	...	...	+	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Mongolia, Cores.
131	,, fasciolatus (*Shaw*)	.....	+	...	...	...	...	...	...	...	...	...	...	+													
132	Xenelaphis hexagonotus (*Cantor*).	.....	...	...	+	...	..	...	...	...	...	...	...	+	+	...	+	...	+								
133	Coluber porphyraceus *Cantor*	.....	+	...	+	...	...	Yunnan	...	...	...	...	...	+	+												
134	,, tæniurus (*Cope*)	Sikhim	...	...	...	...	...	+	...	+	...	+	...	+	+	...	...	...	+	...	...	...	...	...	...	...	Manchuria.
135	,, oxycephalus *Boie*.....	.....	+	...	+	...	...	...	...	...	...	...	...	+	...	...	+	+	+	...	+	...	...	...	...	...	
136	,, melanurus *Schleg.*	.....	...	...	+	...	...	+	...	...	...	...	...	+	+	+	+	...	+								
137	,, radiatus *Schleg.*	.....	+	...	+	...	...	+	...	+	...	+	...	+	+	...											
138	Gonyophis margaritatus (*Peters*)..	.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+								
139	Dendrophis pictus (*Gmel.*)	.....	+	...	+	...	..	...	...	...	+	+	+	+	+	...	+	+	+	+	+	+	+				
140	,, formosus *Boie*	.....	...	...	...	...	..	...	...	...	...	...	...	+	+	...	+	...	+								
141	Dendrelaphis caudolineatus (*Gray*)	.....	+	...	+	...	...	...	...	...	...	...	...	+	+	...	+	+	+	..	+						
142	Simotes purpurascens (*Schleg.*) ...	.....	...	...	...	...	...	+	...	+	...	+	...	+	+	+	+	...	+								
143	,, cyclurus (*Cantor*)	.....	+	...	...	...	...	+	...	+	...	+	...	+	+												
144	,, octolineatus (*Schneid.*) ...	.....	+	...	...	...	...	...	...	...	...	...	...	+	+	...	+	...	+	...	Sulu Is.						
145	,, signatus *Gthr.*	.....	...	...	...	...	...	...	...	...	...	...	...	+													
146	,, tæniatus *Gthr.*	.....	...	...	...	...	...	...	...	+	+	+															
147	,, cruentatus *Gthr.*	.....	..	...	+	...	...	...	...	...	...	...	...	+	+	...	+	...	+								
148	Ablabes tricolor (*Schleg.*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	...	+	+	+								
149	,, baliodirus (*Boie*).....	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	...	...	...	+								
150	,, longicauda *Peters*	.....	...	...	...	...	...	...	...	...	...	...	...	+													
151	Macrocalamus lateralis *Gthr.*	.....	...	...	...	...	...	...	...	...	...	...	...	+													
152	Pseudorhabdium longiceps (*Cantor*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	+	...	...	+	+	+						
153	Calamaria albiventer (*Gray*)	.....	...	...	...	...	...	...	...	...	...	...	...	+													
154	,, sumatrana *Edeling*	.....	...	...	...	...	...	...	...	...	...	...	...	+	+												
155	,, leucocephala *D. & B.*...	.....	...	...	...	...	...	...	...	...	...	...	...	+	+	...	+	...	+								

Table of Species (*continued*).

Consecutive Number.	Nominal List of Species of Reptiles known to occur in Siam or the Malay Peninsula.	Other Countries to the Westward.	India.	Ceylon.	Burma.	Nicobars.	Andamans.	China.	Annam.	Cochinchina.	Cambodia.	Siam (proper).	Lower Siam.	Malay Peninsula.	Sumatra.	Islands round Sumatra.	Java.	Natunas.	Borneo.	Celebes.	Philippines.	Lesser Sunda Is.	Moluccas.	New Guinea	Australia.	Other Countries to the Eastward.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
156	Calamaria pavimentata *D. & B.*	.....	...	...	+	...	...	+	...	+	...	+	...	+	...	...	+									
157	Hypsirhina indica (*Gray*)	.....	...	...	...	...	...	...	...	...	...	...	...	?												
158	,, plumbea (*Boie*)	.....	...	...	+	...	...	+	...	...	...	+	+	+	...	...	+	...	+	+						
159	,, jagorii *Peters*	.....	...	...	...	...	...	...	...	...	...	+														
160	,, enhydris (*Schneid.*)	.....	+	+	+	...	...	+	...	+	...	+	+	+	..	...	...	...	+	+						
161	,, chinensis *Gray*	.....	...	...	...	...	...	+	...	...	...	+														
162	,, boccourtii *Jan*	.....	...	...	...	...	...	...	...	...	...	+	+													
163	,, sieboldii (*Schleg.*)	.....	+	...	+	...	...	...	...	...	...	...	...	+												
164	Homalopsis buccata (*L.*)	.....	...	...	+	...	...	...	...	...	+	+	+	+	+	...	+	...	+							
165	Cerberus rhyncops (*Schn.*)	.....	+	+	+	...	...	...	...	...	...	...	+	+	...	+	+	...	+	+	+	+	+	...	...	Pelew Islands.
166	Fordonia leucobalia (*Schleg.*)	.....	+	...	+	...	...	...	...	+	...	...	...	+	...	...	+	...	+	...	...	+	+	+	+	
167	Cantoria violacea *Gir.*	.....	...	...	+	+	...	...	...	...	...	...	...	+	...	...	...	..	+							
168	Hipistes hydrinus (*Cantor*)	.....	...	...	+	...	...	...	...	...	...	+	+	+												
169	Herpeton tentaculatum *Lacép.*	.....	...	...	...	...	...	...	...	+	...	+														
170	Dipsadomorphus multimaculatus (*Boie*)	.....	...	...	+	...	...	+	.	...	...	+	...	+	+	...	+	...	...	+						
171	,, gokool (*Gray*)	.....	+	Assam	...	...	...	...	...	...	...	...	...	+												
172	,, dendrophilus (*Boie*)	.....	...	...	...	...	...	...	...	...	...	...	+	+	+	...	+	...	+	+	+					
173	,, jaspideus (*D. & B.*)	.....	...	...	...	...	...	...	...	...	...	...														
174	,, drapiezii (*Boie*)	.....	...	...	...	...	...	...	...	...	...	...	...	+	...	...	+	...	+							
175	,, cynodon (*Boie*)	.....	...	Assam	+	...	...	...	...	...	...	...	...	+	...	+	?	...	+	...	+	+				
176	Psammodynastes pulverulentus (*Boie*)	.....	+	Assam	+	...	..	Formosa	...	...	...	+	...	+	+	+	+	+	+	+	+	+				
177	Dryophis xanthozona *Boie*	.....	...	...	...	...	..	...	...	...	...	...	...	+	+	...	+	+	+	+	+	+				
178	,, prasinus *Boie*	.....	+	Assam	+	...	...	...	...	...	+	...	+	+	+	...	+	+	+	+	+	+	+			
179	,, mycterizans (*L.*)	.....	+	+	+	...	...	...	...	...	...	+														
180	Dryophiops rubescens (*Gray*)	.....	...	...	...	...	...	...	...	...	...	+	...	+	+	+	...	+	+							
181	Chrysopelea ornata (*Shaw*)	.....	+	+	+	...	...	+	...	...	...	+	+	+	+	+	+	...	+	+	+					
182	,, chrysochlora (*Reinw.*)	.....	...	...	+	...	...	...	...	...	...	...	...	+	+	+	+	+	+							
183	Hydrus platurus (*L.*)	Obok, Red Sea: Madagascar.	+	+	...	...	...	+	...	...	...	+	...	+	+	...	...	...	+	..	...	...		...	+	Pacific Ocean, across to Panama.
184	Hydrophis cærulescens (*Shaw*)	.....	+	...	...	...	...	...	...	...	...	...	...	+												
185	,, nigrocinctus *Daud.*	.....	+	...	...	...	...	...	...	...	...	...	...	+												
186	,, gracilis (*Shaw*)	Persia.	+	+	+	...	...	...	...	...	...	...	...	+												
187	,, cantoris *Gthr.*	.....	+	...	...	...	...	...	...	...	...	...	...	+												
188	,, fasciatus (*Schn.*)	.....	+	...	...	...	...	+	...	...	...	+	...	+	...	...	...	...	...	...	...	...	..	+		

189	Hydrophis torquatus *Gthr.*	.....	+	...	...	...	...	...	...	...	...	...	+													
190	„ obscurus (*Daud.*)	.....	+	...	+	...	...	...	...	...	...	+	...	...	...	...	...	+								
191	Distira stokesii (*Gray*)	Makran Coast; Indian Ocean.	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	+	
192	„ ornata (*Gray*)	Muscat.	+	+	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	+	+	
193	„ brugmansii (*Boie*)	Persian Gulf.	+	...	+	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...		
194	„ cyanocincta (*Daud.*)	Persian Gulf.	+	+	+	...	...	+	...	...	...	...	+	...	...	...	...	...	...	+	...	...	+	...	Japan.		
195	„ jerdonii (*Gray*)	.....	+	...	...	...	...	...	...	...	...	...	+	...	...	...	+	...	...	...	...	...	...	...		
196	Enhydris hardwickii (*Gray*)	.....	+	...	...	...	...	...	...	...	...	+	...	...	...	...	+	...	...	+	...	...	+	...		
197	Enhydrina valakadien (*Boie*)	Persian Gulf.	+	+	+	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...		
198	Aipysurus eydouxi (*Gray*)	.....	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...	...	+	...	...	...	...		
199	Platurus laticaudatus (*L.*)	.....	+	...	...	...	...	Loo Choo Is.	...	...	...	+	...	...	...	...	...	...	...	...	...	...	+	+	Fiji, N. Hebrides, Tasmania.	
200	„ colubrinus (*Schn.*)	.....	+	...	...	...	...	...	...	...	...	...	+	...	+	...	...	...	Sulu Is.	...	+	...	+	Fiji, N. Hebrides, New Zealand.		
201	Bungarus fasciatus (*Schn.*)	.....	+	...	+	...	...	+	...	...	...	+	+	+	...	+	...	...								
202	„ candidus (*L.*)	.....	+	...	+	...	...	+	...	...	...	...	+	...	...	+	...	...	+							
203	„ flaviceps *Reinh.*	.....	...	...	+	...	...	...	...	+	...	...	...	+	+	+	+	...								
204	Naia tripudians *Merr.*	Transcaspia, Afghanistan.	+	+	...	...	...	+	...	...	...	+	+	+	...	+	...	+	...	+	+					
205	„ bungarus *Schl.*	.....	+	...	+	...	...	+	...	+	...	+	...	+	...	...	...	+	+	+						
206	Callophis gracilis *Gray*	.....	...	...	...	...	...	...	...	...	...	...	+	+												
207	„ maculiceps *Gthr.*	.....	...	...	+	...	...	...	...	+	...	...	+													
208	Doliophis bivirgatus (*Boie*)	.....	...	...	+	...	...	...	...	+	...	+	+	+	+	+	+									
209	„ intestinalis (*Laur.*)	.....	...	...	+	...	...	...	...	...	...	...	+	+	+	+	+	+								
210	Haplopeltura boa (*Boie*)	.....	...	...	...	...	...	...	...	...	...	...	+	...	...	+	...		+	...	+					
211	Amblyocephalus lævis *Boie*	.....	...	...	...	...	...	...	...	...	...	...	?	...	...	+	+									
212	„ malaccanus (*Peters*)	.....	...	...	...	...	...	...	...	...	...	...	+	+	...	...	...	+								
213	„ moellendorffii (*Boettg.*)	.....	...	...	+	...	...	+	...	+	...	+														
214	„ margaritophorus (*Jan*)	.....	...	...	...	...	...	...	...	...	...	+														
215	Vipera russellii (*Shaw*)	.....	+	+	+	...	...	...	...	...	...	+														
216	Ancistrodon blomhoffii (*Boie*)	.....	...	...	...	...	...	+	...	...	...	+	...	...	...	?	...	...	...	...	...	...	...	...	...	Eastern Siberia, Mongolia, Japan.
217	Lachesis monticula (*Gthr.*)	.....	+	...	+	...	...	...	...	...	...	...	+	+												
218	„ purpureomaculatus (*Gray*)	.....	+	...	+	+	+	...	...	...	...	...	+	+												
219	„ gramineus (*Shaw*)	.....	+	...	+	...	...	+	...	...	...	+	+	+	...	+	...	...	...	...	+					
220	„ sumatranus (*Raffles*)	.....	...	...	...	...	...	...	...	...	...	...	+	+	+	...	...	+	Palawan							
221	„ wagleri (*Boie*)	.....	...	...	...	...	...	...	...	...	...	...	+	+	...	...	+	+	+	+						

It will be seen from this table that the Reptiles of the Malay Peninsula have rather more species in common with Borneo than with any of the other great islands. Out of 158 species inhabiting the Peninsula (Turtles and Sea-Snakes being excluded), 103 are also found in other countries on the Continent of Asia, 93 are also found in Borneo, 79 in Sumatra, and 71 in Java.

adaptable to changed circumstances of life, are apparently disappearing.

Very much remains to be done to complete our knowledge of the Agamoid lizards of the Malay Peninsula and Siam. *Draco volans*, *Calotes cristatellus*, and *Calotes versicolor* abound in certain localities and are well known; but the remaining 17 species have only been met with on a few occasions, which, considering their diurnal habits, striking appearance, and frequently brilliant coloration, seems remarkable.

Poisonous Snakes.—Of the 221 species of Reptiles in this list, 34 are poisonous snakes; but of these 18 (*Hydrophiinæ*) inhabit the sea, 4 (*Callophis* and *Doliophis*), owing to their sluggish habits and small mouths, can hardly be considered dangerous to mankind, and 5 (*Lachesis*), so far as is known, are not capable of inflicting a sufficiently poisonous wound to kill a human being. The Vipers *Vipera russelli* and *Ancistrodon blomhoffi*, although recorded from Siam, are not known to occur in the Peninsula. The Krait, *Bungarus candidus*, and its allies *B. fasciatus* and *B. flaviceps* are fortunately rare. Thus only two dangerous species remain which the traveller is likely to come across, viz., the Cobra (*Naia tripudians*) and the Hamadryad (*Naia bungarus*), a proportion which (from what I have read) compares favourably with other tropical countries. Personally I have never come across a Hamadryad wild, but a large Cobra is certainly a difficult and dangerous animal to kill (except with a gun) owing to its strength and power of springing at one[1].

Assistance received.—I have to acknowledge my sense of obligation to the Government officials of the Straits Settlements and the Native States of the Malay Peninsula for their invariable courtesy, assistance, and hospitality; more especially am I indebted to H.H. the Rajah Muda of Kedah, to Lt.-Col. R. Frowd Walker, C.M.G., commanding the Malay States Guides, to Mr. J. P. Rodger, British Resident, Selangor, to the Datu Meldrum, the Datu Hole, and Dr. J. P. A. Wilson of Johore. To the curators of the local Museums, Mr. L. Wray, jun., Mr. A. L. Butler, and particularly Dr. Hanitsch, I am much obliged for kindness in allowing me access at all times to the collections under their charge; and to Mr. H. N. Ridley, Director of the Botanical Gardens, Singapore, and to Mr. C. Curtis, Penang Govt. Gardens, for assistance in collecting; as also to the following gentlemen in Siam—Mr. J. McCarthy, Director of Surveys, Mr. W. Sinclair, Mr. A. J. Dickson, Mr. Austen Shea, Mr. J. S. Smyth, and Mr. N. K. Passmore. But above all I have to thank Mr. G. A. Boulenger, F.R.S., for the invaluable advice and assistance he has given me by correspondence during the last two years.

Nomenclature.—The classification and nomenclature are according to Mr. Boulenger's British Museum Catalogues of Reptiles, where

[1] Hence possibly the "Ular terbang," or Flying Snake, of the Malays. A Madrassee servant, who was with me for some years, often warned me to be careful with Cobras, because they could "fly, same like bird"!

the various synonyms and a description of each species will be found; I have only given other references and remarks on the *description* of species where it seemed these were needed for ready reference by other workers, or where they were made necessary by the fresh material examined during the last few years.

Part III.—List of Species, *with Remarks on their Localities, Habits, Life-coloration, &c.*

Order CHELONIA.

General terms applied to all Tortoises and Turtles:—
Siamese. "Tow-darng-darng."
Malay. "Koora-koora."
Jakun. "Binku." (H. J. Kelsall, J. S. B. R. A. S., No. 26, 1894, p. 7.)

All Tortoises, though not apparently considered actually sacred animals, are held by many Siamese and Chinese in religious veneration, and are kept and fed by the devout in temples and private enclosures. In a Chinese temple in the valley of Ayer Etam in Penang, in April 1898, I saw about fifty tortoises, belonging to five species; many of these had "chops" or Chinese characters stamped on their shells. In Bangkok we were informed that tortoises are kept in order to "make merit" with Buddha; anyway we noticed when living there that, however much our Siamese water-carrier might neglect to bring water for our own use or for other animals in captivity, he never forgot to replenish the supply in the tank where our collection of live tortoises was kept. Once at Ayuthia, in February 1898, I met a Chinaman carrying a fine tortoise, painted with the sacred yellow colour; though I offered him a large sum for the animal he declined to sell it, as he had determined to give it to the shrine of the colossal Buddha there.

There is also a Chinese belief that a turtle can act as a sort of "scape-goat," and take away a man's sins, if it is suitably inscribed and set free. When one of these marked turtles is captured a second time, it is considered more efficacious. And if a turtle is caught whose "chops" show that it has been liberated thus twice, it can be sold by the lucky finder for a very high figure to some man who finds his past misdeeds to hang particularly heavy on his conscience and wishes to have all mention of them erased from "the recording angel's book."

Suborder ATHECÆ.

Family Sphargidæ.

1. Dermochelys coriacea (L.).

Dermochelys coriacea, Blgr. Cat. Chel. etc. p. 10 (skull fig. p. 9).

The Leathery Turtle mentioned as supposed to have been caught near Singapore, P. Z. S. 1896, p. 857, has been found really local.

It was caught at Siglap, Singapore, on the 14th December, 1883, in the presence of Mr. A. M. Skinner, Straits Settlements Civil Service.

Hab. Tropical seas, sometimes occurs in the temperate seas.

Suborder THECOPHOPA.

Superfamily CRYPTODIRA.

Family PLATYSTERNIDÆ.

2. PLATYSTERNUM MEGACEPHALUM Gray.

Platysternum megacephalum, Blgr. Cat. Chel. etc. p. 46.

The Big-headed Tortoise is mentioned in the British Museum Catalogue from Laos. In the Siamese Museum there is a stuffed specimen without locality; it measures:—

Length of head	about	60 mm.
„ „ carapace in median line.....		160 „
„ „ tail		175 „

Hab. Burma, Siam, South China.

Family TESTUDINIDÆ.

3. CALLAGUR PICTA Gray.

4. BATAGUR BASKA Gray.

5. HARDELLA THURGI Gray.

References to the occurrence of these three species of water-tortoises in the Straits Settlements are given in P. Z. S. 1896, p. 858.

At different times I have seen tortoises, some of great size, belonging to this group without being able to identify them, but there are at least two species in the Malay Peninsula, one of which inhabits the coasts (as Cantor remarks) as well as the rivers and ponds. One species (apparently *Callagur picta*) is also found in Siam; we have seen it at Bangkok.

N.B.—Dr. Hanitsch (Report Raffles Library and Museum, 1897, p. 8) records *Kachuga lineata* from Ulu Legeh. I have not seen the specimen.

6. DAMONIA SUBTRIJUGA (Schleg. & Müll.).

Emys macrocephala, Günth. Rept. Brit. Ind. p. 31 (1864).
Damonia subtrijuga, Blgr. Cat. Chel. etc. p. 94 (1889).

The British Museum Catalogue mentions specimens from Siam (M. Mouhot and W. H. Newman) and Cambodia (M. Mouhot). This very handsomely marked and coloured little tortoise is numerous round Bangkok, living apparently always in freshwater ponds and canals and the swampy paddy-fields: in captivity they refuse all food except molluscs, the common blue mussel they crunch up and devour eagerly; they are themselves

eaten by Siamese and Chinese. When excited they make a slight hissing noise. Besides obtaining specimens in Bangkok in January, April, August, October, November, and December, we got one at Ayuthia in February in a small lotus-lily pond.

An egg of this species, laid 17th April, 1897, was (as usual with tortoises) white with a hard shell, and measured 32 mm. on its longer and 20 mm. on its shorter axis.

Colour (in life). Shell chestnut-brown, with a more or less distinct large black spot on each shield; edges of the marginal plates more or less yellow; plastron yellow, each shield with a large black blotch and chestnut-brown markings.

Head black, except the crown, which is rich dark brown, and the following very well-defined markings, which are lemon-yellow:—a semicircle of small spots on the upper eyelid; a streak from the top of the snout to the temple, following the canthus rostralis and the supraorbital edge; a broader streak, nearly joining the last, starting from the superior-posterior corner of the eye and continued along the side of the neck; below this is an interrupted line of oblong spots commencing at the posterior border of the eye and continued down the neck; a broad streak commences on the loreal region and finishes at the angle of the mouth; two vertical streaks from the nostrils to the mouth, outside and parallel to these streaks are two vertically oblong spots; the edge of the upper mandible is also yellow; a very distinct V-shaped mark on each side of the mandible; from the angle of the mouth a yellow streak descends to the lower surface of the head and there expands into a large spot, and another streak runs back along the neck. Neck dark brown, with four narrow yellow lines along each side, some very small yellow spots above, and numerous yellow vermiculations beneath. Limbs black or dark brown, with lemon-yellow markings. Tail dark brown, with longitudinal yellow lines converging at the tip. Iris very narrow, yellow.

Size. A female from Bangkok, adult, measured:—

Width of head, 37 mm.

Carapace, length, in straight line 155 mm.; following the curve 167 mm.

Carapace, width, in straight line 122 mm.; following the curve 153 mm.

Hab. Siam, Cambodia, Java.

7. Bellia crassicollis Gray.

Emys crassicollis, Cantor, p. 3; Günth. Rept. Brit. Ind. p. 28, pl. iv. fig. E; Stol. J. A. S. B. 1870, vol. xxxix, part ii. p. 227.

Bellia crassicollis, Blgr. Cat. Chel. etc. p. 98 (skull fig. p. 98, shell fig. p. 99).

The Black Tortoise is common in small freshwater streams and ponds in Penang and Kedah; it is one of the species kept by the Chinese priests in the Ayer Etam Tortoise Temple. Apparently, like some other freshwater tortoises, this species is very local, as there is no specimen of it in the Perak Museum and I have not

seen it from Singapore. The British Museum Catalogue mentions one specimen from Siam (M. Mouhot), and I obtained one from the neighbourhood of Bangkok. Cantor says it feeds upon frogs, shell-fish, and animal offal. It can hiss when angry.

Colour (in life). Carapace uniform intense black. Plastron entirely black, or black with some yellow mottlings, or rich dark brown with pale bands following the sutures of the shields, the most conspicuous being the median one.

Head black, with conspicuous lemon-yellow spots, the principal being above the eye (this spot is prolonged forwards on to the top of the head), above the ear, and at the angle of the mouth, and an irregular patch along each lower jaw to below the eye; in some adult specimens these spots disappear, the whole head being deep black. Neck, hands, feet, limbs, and tail are deep black, the upper parts of the limbs are, however, sometimes pale-coloured. Claws horn-colour. Iris dark brown.

Size. The largest specimen I have measured I found in a pond in the jungle on low undulating hills near Jenan, Kedah.

Length of carapace, following curve in median line .. 200 mm.
Breadth „ „ „ ..... 170 mm.

The smallest, caught in Kedah, June 1898, had the carapace 53 mm. in length.

Males and females do not seem to differ much in size.

Hab. Tenasserim, Siam, Malay Peninsula, Sumatra, and Borneo.

8. Cyclemys platynota Gray.

Emys platynota, Cantor, p. 3.
Notochelys platynota, Günth. Rept. Brit. Ind. p. 17.
Cyclemys platynota, Blgr. Cat. Chel. etc. p. 130.
"Kátong" of the Malays (*apud* Cantor).

Localities. The Flat-backed Freshwater Tortoise lives in ponds and swampy jungles; its occurrence seems rather strange. Cantor obtained it from Penang (apparently only a single specimen), but it has not been recorded from there since, and there was not one in the Ayer Etam Tortoise Temple when I visited it in April 1898. A. R. Wallace obtained it in Singapore, but apparently no more were seen in the island (Mr. Ridley informs me that for seven years he never met this species) till 1897, when one was caught in the lake in the Singapore Botanical Gardens, and Dr. Hanitsch got three from Selitah, Singapore.

Cantor says it inhabits the valleys of the Malay Peninsula, but unfortunately does not give the actual localities; however, we now know of two places on the mainland where it occurs. First, in the Perak Museum there are several specimens from the low-lying country near Taiping; second, in September 1897 I found eighteen individuals in the streams among the foot-hills of Gunong Pulai, Johore.

Identification. In the P. Z. S. 1896, p. 859, I wrote: "I have not made out to what species Cantor's Penang Tortoise belongs," referring to Günther, R. B. I. p. 18, remarking that Cantor's *Emys*

platynota "was certainly an incorrect determination, as is evident from his description." However, on comparing Cantor's description with living specimens of *C. platynota* (subsequently identified as such by Mr. Boulenger), I have no doubt he refers to this species, and the description appears good.

Varieties. There appear to be two fairly distinct varieties occurring in the same localities, differing in the number of vertebral shields (5 and 6 respectively), in the general shape of the carapace, and in the colour of the head.

Habits. When alarmed the Flat-back hisses after the manner of tortoises, and in common with some other species, but to a greater extent, it has the very objectionable habit of voiding excrement time after time when it is picked up or handled; however when, after some weeks, it gets used to being handled it ceases to do so. In captivity it spends all its time by preference in shallow water; it feeds most voraciously on almost any vegetable, but prefers fruit, of which it will get through a large quantity in a day. It is curious to see with how much energy two or three of these tortoises will fight over a piece of banana. Out of about fourteen species of tortoises which I have kept as pets, these Flat-backs, although the least ornamental to look at owing to their nearly uniform muddy-brown colour, are the most active and intelligent; they quickly get tame and learn to run up to one and even follow for some little way if rewarded by a piece of fruit, they will climb out of boxes and baskets which other tortoises never find their way out of, and I have seen two of them attack a big water-snake (*Acrochordus javanicus*). The battered condition which their shells sometimes are in may perhaps be accounted for by their enterprising nature. Cantor's experience of his *platynota* differs from mine, as he says: "It lived in my garden at Penang upwards of a twelvemonth, apparently without food, and it was never observed to enter a tank." But Dr. Hanitsch, who has a collection of live tortoises at Singapore, has remarked the tameness and voracity of this species [1].

Size. The largest specimen I have measured, a male from Johore, is in length of carapace, following the curve, 280 mm.

Hab. Mergui, Malay Peninsula, Sumatra, and Borneo.

9. CYCLEMYS DHOR (Gray).

Cyclemys oldhamii, Günth. Rept. Brit. Ind. p. 15, pl. v. fig. B.
Cyclemys dhor, Blgr. Cat. Chel. etc. p. 131.

The British Museum Catalogue mentions two specimens from the Laos Mountains, collected by M. Mouhot. I can find no direct evidence of its occurrence in the Malay Peninsula (*vide* P. Z. S. 1896, p. 859).

Hab. Northern India, Burma, Siam, Cambodia, Malay Peninsula, Java, Borneo, and Mentawei Islands (Sipora).

[1] A specimen of *C. platynota* in the Ghizeh Zoological Gardens repeatedly climbs out of an enclosure where five other species of tortoises are kept and remain; the side is of vertical "rabbit-wire" netting three feet high.—25.3.99.

10. Cyclemys mouhotii Gray.

Cyclemys mouhotii, Blgr. Cat. Chel. etc. p. 132.

The type specimens collected by M. Mouhot in the Laos Mountains are in the British Museum.

Hab. Siam, Cochinchina, Cachar.

11. Cyclemys amboinensis (Daud.).

Cistudo amboinensis, Cantor, p. 5.

Cuora amboinensis, Günth. Rept. Brit. Ind. p. 12, pl. iv. figs. A, B.

Cyclemys amboinensis, Blgr. Cat. Chel. etc. p. 133 (skull fig. p. 128; shell fig. p. 129).

"Báning" of the Malays, according to Cantor.

"Kura kura patah" of the Perak Malays, according to L. Wray.

Localities. The Box-Tortoise is the chelonian most frequently met with in the Straits Settlements, and seems generally distributed in the low country, living in ponds, streams, and paddy-fields. I have seen specimens from Alor Star in Kedah, from Penang, from Taiping in Perak, from Malacca, and from Singapore. There are a score or more living in the Ayer Etam Tortoise Temple. I did not meet this species myself in Siam proper, but the British Museum Catalogue mentions a specimen from Siam.

Habits. When first caught they are very shy; for some weeks on being touched they will at once shut themselves up in their shells, but they gradually get used to people being about them. They feed fairly regularly on vegetables, preferring bananas, but only eat small quantities at a time (a great contrast to the greedy *C. platynota*).

Size. An adult male from Kedah measured:—

Length of carapace following curve	216 mm.
Breadth „ „ „	214 „

Hab. Burma, Siam, Malay Peninsula, Borneo (I met this species at Brunei), Celebes, Gilolo, Amboina, and Philippines.

12. Geoemyda spinosa Gray.

Geomyda spinosa, Blgr. Cat. Chel. etc. p. 137; S. Flower, P. Z. S. 1896, p. 859.

Localities. The Spinous Tortoise is found in jungle-streams apparently only in the hills, in Penang and Perak at elevations of some thousand feet above the sea, but in Singapore it is found on Bukit Timah at less than 500 feet. It is one of the mountain forms which are thus found at a low elevation in Singapore, as if Bukit Timah had once equalled the more northern granite hills in height, and when it gradually sank by subsidence or denudation the animals and plants on it had to accommodate themselves to this lower level. I find that Cantor noticed this, having written in 1847 of Singapore:—"In the valleys occur vegetable and animal forms which at Pinang have been observed at or near the summit of the hills, but not in the plains. Thus, at Singapore occur *Also-*

phila, Schizæa, Tacca cristata, Gnetum, Nepenthes, Begonia, Eurycoma, and others, which at Pinang appear to affect a much greater elevation. Instances of reptiles in common to the plains of Singapore and the hills of Pinang are:—*Ptychozoon homalocephalum, Gymnodactylus pulchellus, Lygosoma chalcides, Pilidion lineatum, Typhlops nigro-albus, Calamaria lumbricoidea*, var., *Leptophis caudalineatus, Elaps intestinalis, E. nigromaculatus.*"

Dr. Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 9) records this species from Ulu Legeh.

Habits. Lives day and night in the water and feeds on fruit and vegetables.

Size. A fine specimen from Government Hill, Penang, with a remarkably depressed carapace measures:—

Length of carapace following curve .... 198 mm.
Breadth „ „ „ .... 190 „

Hab. Tenasserim, Malay Peninsula, Sumatra, and Borneo (I met this species at Sandakan and Brunei).

13. GEOEMYDA GRANDIS Gray.

Geoemyda grandis, Blgr. Cat. Chel. etc. p. 138.

Localities. This grand Tortoise was originally described from specimens from Pachebone (Siam) and Cambodia collected by M. Mouhot; since then it has been recorded from Burma, and now three States in the Malay Peninsula can be added.

1st, Penang. On visiting the Ayer Etam Tortoise Temple in April 1898, we saw many of these fine tortoises there, said to have been caught on the island.

2nd, Province Wellesley. In the same month Mr. Bowen, Sheriff of Penang, when on a shooting expedition in the Province, caught a tortoise which he kindly gave me, which proved to belong to this species.

3rd, Kedah. In May and June 1898 I found it very numerous in the neighbourhood of Alor Star, living in ponds, ditches, and flooded paddy-fields.

I have not seen it wild near Bangkok, but a very large water-tortoise which is kept in some old palace and temple tanks (together with the species, apparently *Callagur picta*, mentioned above) probably is *Geoemyda grandis*, but these old individuals are so covered with a thick slimy green vegetable growth that they are difficult to identify.

The "sacred" tortoise I saw at Ayuthia, mentioned above, also apparently belongs to this species, as does a carapace I picked up in the bed of a dried-up pond at Pachim, on the Bangpakong River, in March 1897.

Dr. Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 9) records *Geoemyda grandis* from two localities in the Malay Peninsula; the specimens, which he kindly allowed me to examine when passing through Singapore, are, however, in one case *Bellia crassicollis*, and in the other *Cyclemys platynota*.

Habits. Freshwater tortoises, but active when walking on

land, and large specimens are very powerful. When touched or picked up, they draw in their legs and hiss loudly; when turned on their backs, they sometimes utter a little plaintive cry. The jaws of old individuals are of great strength and wonderfully jagged at the edges, almost like a series of teeth. They are vegetable-feeders.

Colour (in life). Skin of head and neck very dark brown, closely vermiculated with dark yellow-ochre, except cutting-edge of lower jaw, which is yellow. The bare skin from angle of mouth to tympanum is white. Iris pale yellow; space round iris light red, with dark brown radiating lines. Tongue flesh-coloured.

Size. Out of about twenty individuals from Kedah examined, the largest male measured:—

Length of carapace following curve	383 mm.
Breadth „ „ „	329 „

The largest female measured:—

Length of carapace following curve	320 mm.
Breadth „ „ „	278 „

However, a tortoise from Bangkok, which I believe belonged to this species (which I had intended presenting to the Zoological Society, but was unfortunately lost in the wreck of the P. & O. s.s. 'China' at Perim when on its way to London), was much larger, and measured:—

Length of carapace following curve	457 mm.
Breadth „ „ „	387 „

In June 1898 young tortoises of this species appeared in Kedah with the carapace only about 50 mm. long; they are very different in appearance from the adults.

Hab. Burma, Siam, Cambodia, Malay Peninsula.

14. Testudo emys Schleg. & Müll.

Manouria emys Günth. Rept. Brit. Ind. p. 10.

Testudo emys Blgr. Cat. Chel. etc. p. 158 (skull fig. p. 150).

"Baning" of the Perak Malays, according to L. Wray.

Localities. The upland Land-Tortoise does not seem to have been met with in the Penang Hills since Cantor's time, and there were no specimens of it in the Ayer Etam Tortoise Temple when I visited it. In the Larut Hills in Perak, however, it seems to be not uncommon, and there are several specimens in the museum at Taiping. The only other locality in the Peninsula that it is recorded from is the Dindings (P. Z. S. 1896, p. 860). The British Museum Catalogue mentions a specimen from Siam.

Hab. Assam, Burma, Siam, Malay Peninsula, Sumatra, Borneo.

15. Testudo elongata Blyth.

Testudo elongata Blgr. Cat. Chel. etc. p. 173.

Localities. The Elongated Land-Tortoise seems to be a hill-

species, but I have never caught it wild myself. A specimen that was given me alive, at Bangkok, had unfortunately no history, except that it came from somewhere "up country." At Hinlap, in the Dong Phya Fai (Forest of the Lord of Fire), 700 feet above the sea, I found a carapace near the village. In the King of Siam's gardens, in Bangkok, there are several individuals, but I could not ascertain where they came from originally. In the Ayer Etam Tortoise Temple I was surprised to see two specimens of *T. elongata*, as it has not hitherto been recorded from the Peninsula. The man in charge told me they were caught in the Penang Hills; and it is probably true, as one cannot well imagine why they should be brought there from Burma, as Ayer Etam is situated in the interior of Penang, almost surrounded by hills, some miles from the coast. The British Museum Catalogue mentions specimens from the Laos Mountains and Cambodia, collected by M. Mouhot, and one specimen from Cochinchina.

Description. A Penang specimen had no nuchal shield.

Habits. Those of most land-tortoises, hisses when alarmed, eats vegetable foods, and appears to prefer bananas to anything else.

Colour (in life). Carapace and plastron very pale yellowish brown, each scale with an irregular black blotch. Head and neck very pale green, almost white. Limbs pale greenish horn-colour. Iris very dark brownish grey, almost black.

Size. A Siamese specimen, now in the Zoological Society's Gardens, measured in May 1897:—

Length of carapace following curve	300 mm.
Breadth „ „ „	248 „

The Hinlap specimen measured, length of carapace following curve 330 mm.

A Penang specimen measured:—

Length of carapace following curve	350 mm.
Breadth „ „ „	312 „

Hab. Bengal (Chaibassa), Burma, Siam, Cambodia, Cochinchina, and Malay Peninsula.

Family Chelonidæ.

The three species of Sea-Turtles are collectively called by the Siamese:—

"Tou," applied to any tortoise or turtle.

"Tou-ta-noo" *or* "tou-ta-nuk," } any big turtle.
"Ta-noo-tou," }

"Samett," local name for Sea-Turtles at Kofai, Gulf of Siam; and by the Malays "kúra," "penyu," or "pinyú."

In calm weather, in the Straits of Malacca and in the Gulf of Siam, one not unfrequently, when on board a steamer, passes a turtle swimming near the surface, sometimes showing only its broad curved back or its long flippers, sometimes putting its head right up out of the water.

16. CHELONE MYDAS (L.).

Chelonia virgata, Cantor, p. 11; Günth. Rept. Brit. Ind. p. 53.
Chelone nydas, Blgr. Cat. Chel. etc. p. 180.

The Edible or Green Turtle occurs in the Straits of Malacca and Gulf of Siam; there are two specimens from the coast of Perak in the Taiping Museum; I got one in Singapore in Sept. 1898. In the Siamese Museum are the skulls and shells of two individuals from Kofai, also a large stuffed specimen from the same island, caught about 11th May, 1897; it was a female, and contained a large number of eggs. It had one claw on each front flipper (a specimen I saw on the coast of Ceylon, Sept. 1898, had on each flipper one distinct claw and one rudimentary).

Turtles' eggs are esteemed a luxury by the Siamese, and it seems the turtle-egg industry at Kofai is farmed out by Government, and the farmers' people take good care no one else catches the turtles when they come ashore to lay their eggs on the island.

Size. The female from Kofai, Gulf of Siam, measured:—

Length of carapace following curve	1108	mm.
Breadth „ „ „	1016	„
Length of tail, from posterior side of vent to tip.	86	„
„ fore flipper..... about	673	„
„ hind flipper	419	„

Hab. Tropical and subtropical seas.

17. CHELONE IMBRICATA (L.).

Chelonia imbricata, Cantor, p. 13.
Caretta squamata, Günth. Rept. Brit. Ind. p. 54.
Chelone imbricata, Blgr. Cat Chel. etc. p. 183 (skull fig. p. 181); Blgr. Fauna Brit. Ind., Rept. p. 49 (young fig.).

The Hawksbill Turtle occurs in the Straits of Malacca and in the Gulf of Siam. One from Singapore was recorded in the P. Z. S. 1896, p. 680. The Siamese Museum contains three half-grown specimens from Kosichang, and in August 1898 I obtained an adult off the same island.

Hab. Tropical and subtropical seas.

18. THALASSOCHELYS CARETTA (L.).

Chelonia olivacea, Cantor, p. 13.
Caouana olivacea, Günth. Rept. Brit. Ind. p. 52.
Thalassochelys caretta, Blgr. Cat. Chel. etc. p. 184.

The Loggerhead Turtle occurs in the Straits of Malacca and in the Gulf of Siam, but is apparently less common than either of the preceding species. There is a specimen from Penang in the Taiping Museum; one from Singapore was recorded in the P. Z. S. 1896, p. 860. The Siamese Museum contains a skull from Kofai; also a carapace, 698 mm. in length, from the same island, possibly belongs to this species.

Hab. Tropical and subtropical seas.

Superfamily TRIONYCHOIDEA.

Family TRIONYCHIDÆ.

The Soft Turtles are known to the Siamese as "Ta-parp-naam" and "krow."

Some of the Indian inhabitants of Penang call them "Cawchur." (In Benares, N.W.P., they were called "Cawchóo.")

In the Taiping Museum there are several specimens of more than one species from the rivers and marshes of Perak. A large *Trionyx* was caught recently in a ditch by the side of one of the principal roads in Singapore, right in the town; they are also from time to time trapped in the ornamental water in the Botanical Gardens there. Mr. Ridley, Director of the Gardens, tells me they are unwelcome visitors; not only do they steal the food put out for the water-fowl, but they have killed two flamingoes which had been imported from Egypt. In the lake (Singapore) I have myself watched in the middle of the day two large *Trionyx* swimming and creeping slowly about in the swallow order, raising their heads to the surface at frequent intervals; but as a rule these turtles are very seldom seen, even in waters where there can be no doubt they abound.

19. TRIONYX SUBPLANUS Geoffr. (Plate XXXVI.)

Trionyx subplanus, Günth. Rept. Brit. Ind. p. 49.

Trionyx güntheri, Günth. Rept. Brit. Ind. p. 49, pl. iv. fig. 4.

Trionyx subplanus, Blgr. Cat. Chel. etc. p. 246 (skull fig. p. 247).

Trionyx subplanus is recorded from Penang and Singapore (P. Z. S. 1896, p. 860). In November 1896 I obtained one specimen in Penang; like other turtles of this genus, it tried fiercely to bite when handled.

Colour (in life). The upper surfaces are pale yellowish olive, mottled all over with dark olive-brown. These markings are darker down the centre of the back, thus forming an irregular black vertebral line. There are also three pairs of indistinct eye-like markings, the anterior pair being situated almost at the front edge of the dorsal leather-shield. The remaining four eyes form a parallelogram on the centre of the back, but the posterior pair are slightly nearer together than the median pair. There is a narrow light yellow edge to the posterior half of the dorsal leather-shield. The under surfaces are very pale lemon-yellow. About the head there are shades of red on the yellow ground-colour. There are five dark lines on the head; the outermost spring from the posterior border of the eyes, and are continued backwards and downwards on to the sides of the neck; in the centre of the forehead, level with the anterior border of the eyes, a dark line commences and runs back and bifurcates, thus forming a Y-shaped mark between and behind the eyes; at the extremities of the branches of the Y the two lines converge together again for a

short distance, and then trend outwards again and are continued back on to the neck, gradually getting thinner and fainter; the fifth dark line is median, commencing in the fork of the Y, but without joining it, and running back on to the neck, gradually getting fainter and disappearing considerably in front of where the inner pair of dark lines cease. Iris pale gold.

Size. This Penang specimen measured, after death:—

Length of dorsal leather-shield.....	190 mm.
Breadth „ „	145 „
Length from snout to tip of tail	340 „

When it was alive the dorsal leather-shield had been about 202 mm. long.

Hab. Mergui, Malay Peninsula, Sumatra, Java, and Borneo.

20. TRIONYX HURUM Gray.

Gymnopus gangeticus, Cantor, p. 8.
Trionyx gangeticus, Günth. Rept. Brit. Ind. p. 47.
Trionyx hurum, Blgr. Cat. Chel. etc. p. 249; Blgr. Fauna Brit. Ind., Rept. p. 13 (young fig.).

This species does not seem to have been met with in the Straits Settlements since Cantor's time, who says "it is of fierce habits, desperately defending itself by biting, emitting when excited a low, hoarse, cackling sound."

Hab. Ganges and Malay Peninsula.

N.B.—Dr. Hanitsch (Rep. Raffles Libr. & Museum, 1897, p. 9) records *Trionyx hurum* from Ulu Legeh. I saw the specimen, but could not identify it myself.

21. TRIONYX PHAYREI Theob.

Trionyx phayrii, Blgr. Cat. Chel. etc. p. 251 (skull fig. p. 252).

Phayre's Soft Turtle was recorded from Penang (Anderson, J. A. S. B. 1871, p. 30), and in September 1897 I obtained one specimen in a stream among the foot-hills of Gunong Pulai, Johore.

Hab. Burma, Malay Peninsula, Java, Borneo.

22. TRIONYX CARTILAGINEUS (Boddaert).

Gymnopus cartilaginea, Cantor, p. 9.
Trionyx ornatus, Günth. Rept. Brit. Ind. p. 48, pl. iv. fig. B.
Trionyx cartilagineus, Blgr. Cat. Chel. etc. p. 253 (skull fig.).

Localities. This is apparently the most numerous species of Soft Tortoise, both in the Malay Peninsula and Siam, living in rivers and ponds. The British Museum Catalogue mentions specimens from Penang (Cantor), and from Siam and Cambodia (Mouhot). The only specimens I obtained were from Bangkok.

Habits. This *Trionyx* is very fierce and bad-tempered; one that I kept for seven and a half months, and tried to tame, remained just as intractable as when first caught, biting at anything that approached it. They can bite hard, too, and it is very difficult to get them to let go of anything they have seized, unless they

happen to take a piece right out. The sudden way in which they shoot out and then retract their long necks, and their great strength, make them formidable animals. I have seen one of mine seize a stick pointed at it by a visitor and instantly break it in two, and one that I once had occasion to take for a drive in a carriage occupied itself in worrying a cushion and did not a little damage. Like *Damonia subtrijuga*, they are fond of eating blue mussels; this was the only food I ever saw mine eating, though they were supplied with fish, frogs, and crustaceans (dead and alive), as well as with vegetables, though the *Trionyx* which Mr. Ridley keeps in Singapore eat rice. These turtles are eaten by the Chinese and by some classes of Siamese. The eggs are hard-shelled, white, and spherical. The young turtles are to be found during the latter half of July and in August; they try to bite lustily.

Colour (in life). Above olive-brown, beneath white, head and neck with numerous distinct small yellow spots.

Size. An adult female from Bangkok measured:—

Length of dorsal leather-shield	268 mm.
Breadth „ „	230 „
Length of head and neck	205 „

Hab. Burma, Siam, Cambodia, Malay Peninsula, Sumatra, Java, Borneo.

23. PELOCHELYS CANTORIS Gray.

Gymnopus indicus, Cantor, p. 10.
Chitra indica, Günth. Rept. Brit. Ind. p. 50, pl. vi. fig. C.
Pelochelys cantoris, Blgr. Cat. Chel. etc. p. 253 (skull fig.).

Cantor's Soft Turtle was described from a Penang specimen. Cantor writes of this species:—"*Hab.* Pinang, Malayan Peninsula (estuaries, sea-coast), rivers in India, Philippine Islands. At Pinang this species is frequently taken in the fishing-stakes. The Chinese inhabitants greatly relish this, as well as the preceding species of *Gymnopus* (i. e. *Trionyx*), as articles of food. Individuals weighing 240 lbs. occur in the Ganges, and others of gigantic dimensions are not uncommon at Pinang. It is very powerful, and of ferocious habits."

I obtained a specimen from the Kedah river; the dry and somewhat shrivelled dorsal shield measured 641 mm. in length and 552 in breadth. But Cantor measured a much larger individual, whose "shell" was 940 mm. in length. This Kedah specimen is apparently the first record of this species in Siamese territory, and it probably also occurs in Siam proper, as a half-grown specimen in the Siamese Museum, caught in the river Menam, appears to belong to this species, and also a little Soft Turtle, caught on the 29th March, 1897, in the Bangpakong river, a little below Kabin, may be; Mr. Boulenger writes of this individual:—"I doubt the *Trionyx* being *Pelochelys cantoris*, but the affinities of so young a specimen cannot be well understood."

The colours, in life, of this Bangpakong turtle were: above dark olive-green, with pale olive-green markings, and a broad pale yellow margin to dorsal leather-shield (except in front); underneath it was pale yellow and buff immaculate. Five pale longitudinal lines on the neck. Iris golden.

Hab. Ganges, Burma, China, Siam, Malay Peninsula, Borneo, Philippines.

Order EMYDOSAURIA.

Family CROCODILIDÆ.

Siamese. "Takhay."
Malay. "Buaya."

H. J. Kelsall (J. S. B. R. A. S. no. 26, 1894, p. 8) says that Crocodiles are said to occur in the Kahang river, in the interior of Johore, and are called "bagin" by the Jakuns, both on ordinary occasions (p. 55) and when using the Camphor[1] language (p. 47).

The Malays tell me there are two sorts of Crocodile in the Kedah river—the usual one (*C. porosus*), which grows to a great length, and is of comparatively slender build, and a rarer one, which does not usually grow long, but is very bulky; one of this sort was killed near Alor Star on the 24th May, 1898, which was about 4·26 metres (14 feet) long; I arrived at the place next day, but was, unfortunately, too late to see the body; possibly this may be *Crocodilus palustris*.

24. TOMISTOMA SCHLEGELI (S. Müller).

Tomistoma schlegelii, Blgr. Cat. Chel. etc. p. 276; Blgr. P. Z. S. 1896, p. 628.

"Buaya jinjulong" of the Selangor Malays according to A. L. Butler, and of the Perak Malays according to L. Wray.

The Malay Gharial is now known to occur in the States of Perak and Selangor, on the west coast, and of Pahang, on the east coast of the Peninsula; it is apparently unknown in Kedah. Besides the specimens in the British and Taiping Museums, from the Perak river, I saw, in December 1896, two skins from the same river belonging to Captain H. C. Metcalfe, 58th Regt. In the Kuala Lumpor Museum there is a specimen from Kuala Selangor, 1895, given by the late Captain H. C. Syers. In August 1897 I saw a large skull, said to be from the Pahang river, belonging to Mr. J. H. Lindsay; the gharial is said to have seized a dog swimming in the river, and to have been subsequently killed by the dog's master some miles up-stream from Pekan.

Size. The Pulo Tiga specimen sent by Mr. Wray to the British Museum measured 2·64 metres (8 feet 9 inches). The British

[1] The Jakuns, while on the search for camphor (*Dryobalanops aromatica*, Gaertn.), taboo their ordinary language, and use a special one; not only the men searching in the jungle, but also their families left in the villages conform to this ancient superstition.

Museum Catalogue says of this species: it "reaches a length of 4·5 metres" (14 feet 9 inches).

Hab. Malay Peninsula, Sumatra, and Borneo

25. CROCODILUS SIAMENSIS Schmidt.

Crocodilus siamensis, Günth. Rept. Brit. Ind. p. 61, pl. viii. fig. B; Blgr. Cat. Chel. etc. p. 282.

But little seems to be known of this species, first described from a skull sent by French missionaries from Siam to the Paris Museum, about, or before, the year 1801.

The only specimen in the British Museum was procured in Cambodia by M. Mouhot; it is 1·38 metres long. It is not represented in the Siamese Museum so far.

Hab. Siam, Cambodia, Java.

26. CROCODILUS POROSUS Schn.

Crocodilus porosus, Cantor, p. 16; Günth. Rept. Brit. Ind. p. 62; Blgr. Cat. Chel. etc. p. 284; S. Flower, P. Z. S. 1896, p. 862.

Crocodilus pondicerianus, Günth. Rept. Brit. Ind. p. 62, pl. vii.

Localities. This crocodile is exceedingly numerous in every suitable locality in Malaya, and is also found in the tidal rivers of Siam. Malay fishermen tell me that formerly crocodiles were to be seen along the coast of Penang, but now they thought they were only to be found on the coast of Province Wellesley, on the mainland; these men, that I happen to know, however live and work on the east and north coasts; and Mr. Wilkinson, Straits Settlements Civil Service, tells me some crocodiles still remain in the swamps on the west or seaward side of the island.

Every year many people lose their lives in the Peninsula by being seized and carried off by crocodiles, and many extraordinary stories are told of them.

In Kedah, in May and June 1898, I found this species as numerous as I had previously in April 1895. In the Prye and other rivers of the Province Wellesley there are still many crocodiles; I have seen specimens in Mr. A. G. B. Van Sommeren's collection at "Strawberry," Penang Hill, and in the possession of Mr. A. H. B. Dennys. In Perak it is also numerous, as testified by specimens in the Taiping Museum. Col. Frowd Walker, C.M.G., has a specimen caught in the lake of the Taiping public park; and Captain Duff, of the s.s. 'Thaipeng,' which runs between Georgetown, Penang, and Port Weld, Perak, tells me he frequently sees them in the estuaries of Larut. In the museum at Kuala Lumpor there are many specimens killed in Selangor. In the quieter parts of Singapore Island crocodiles can always be found, and at times they even wander into the busiest parts. I hear, on good authority, that one was shot in the spring of 1898 from the Tanjong Pagar wharf, where all the big steamers from Europe, India, and China lie, and day and night there is a constant bustle of men, mails, cargo, and coal.

This species is also found on the coast of Johore, and there is a skull from Pahang, on the east side of the Peninsula, in the Taiping Museum. The Siamese Museum contains specimens from the Tacheen river and from Ayuthia, and I have met them myself on the Bangpakong river, between Pachim and Patriew. In Bangkok crocodiles are kept in a tank in the Royal Gardens, and in at least one of the temples.

Nowadays it is not seen wild in the immediate neighbourhood of Bangkok, but in 1778, in Dr. Koenig's journal (J. S. B. R. A. S. no. 26, 1894), we read:—"November 8th: The Crocodiles swam in front of our boat; they often made a dreadful noise, but the people said we had nothing to fear from them here, they are only dangerous further inland . . . Nov. 27th: The people offered the flesh of a big crocodile for sale . . . the tail was best, and had no smell at all. The King of Siam pays for every crocodile . . . in order to extirpate these animals. Therefore the crocodiles are afraid of any boat here, but higher up the country they attack people and eat them;" and such other entries.

Size. The length to which these crocodiles attain is often a matter of discussion, and it is difficult to estimate when they are seen in the water. One from Ayuthia, Siam, I measured was 3·04 metres (10 feet). One shot by Mr. Owen at Serangoon, Singapore, measures as it is now, in the Raffles Museum, 4·7 metres (15 feet 6 inches); but Mr. Owen tells me it was 16 feet in total length in the flesh.

The largest I have seen in Kedah, lying dead on the river-bank, was about 3·67 metres (12 feet).

Col. Frowd Walker, C.M.G., has in his house at Taiping the skull of a crocodile from Perak which measures in total length about 812 mm. (2 feet 8 inches); he tells me the animal was 5·48 metres (18 feet) long, and a noted man-eater, knocking people off the bathing-stages by the river's side.

Mr. J. P. Rodger tells me that about the year 1886 the Government reward was paid for a crocodile killed at Kuala Selangor 5·64 metres (18 feet 6 inches) long. In the Taiping Museum there is a strip of skin, from the snout to the end of the tail, of a crocodile killed at Matang, Perak, presented to the museum by Mr. E. Wagner, and which, Mr. L. Wray informed me, measured 7·51 metres (24 feet 8 inches).

The British Museum Catalogue says "the largest specimen in the collection measures 5·25 metres;" and in reference to a skull from Bawisaul, Bengal, says, in a footnote: "Stated by the donor to have pertained to a specimen 33 feet long, and measuring 13 feet 8 inches round the body."

Dimensions of skulls:—

1st. From Tacheen river, Siam, now in Siamese Museum.

Total length (without lower jaw)	about 901 mm. (2 ft. 11½ in.).
Breadth in front of orbits (following curve)	about 444 mm. (1 ft. 5½ in.).

2nd. Locality unknown, now in Raffles Museum, Singapore.

Total length (with lower jaw?)	about 977 mm. (3 ft. 2½ in.).
Breadth in front of orbits (following curve)	about 438 mm. (1 ft. 5¼ in.).

3rd. From Pahang, now in Taiping Museum, presented by Mr. G. F. W. Curtis.

Total length (including lower jaw)	about 901 mm. (2 ft. 11½ in.).
Breadth in front of orbits (following curve)	about 387 mm. (1 ft. 3¼ in.).

This specimen is labelled *C. palustris*, but I should call it *C. porosus*.

Colour (in life). Dark olive-brown (sometimes nearly black) and bright lemon-yellow. Iris yellow.

Egg. An egg, supposed to belong to this species, from Johore, given me by Dr. Wilson, measures on its longer axis 80 mm.

Hab. India, Ceylon, Burma, South China, Siam, Malay Peninsula, Java, Borneo, Celebes, Philippines, New Guinea, North Australia, Solomon and Fiji Islands.

27. CROCODILUS PALUSTRIS Lesson.

Crocodilus vulgarus, Cantor, p. 15.

Crocodilus palustris, Günth. Rept. Brit. Ind. p. 61, pl. vii. fig. A; Blgr. Cat. Chel. etc. p. 285; Blgr. Fauna Brit. Ind., Rept. p. 5 (skull fig. p. 2).

The Marsh-Crocodile or Mugger is recorded from the Malay Peninsula on the authority of Cantor, and because of a young specimen from Singapore in the British Museum.

In the Taiping Museum are two skulls which Mr. L. Wray refers to this species, one from Pahang, given by Mr. G. F. W. Curtis (mentioned above), and a rather smaller one from Sapetang, given by Mr. A. T. Dew; but after examining them and comparing them with skulls which Mr. Wray acknowledges to be *C. porosus*, I can see no reason why they should not also be *C. porosus*.

Cantor's account of this species is very interesting, but it is an open question whether he has confused it with *C. porosus* or not. He writes:—"It inhabits not only rivers and estuaries, but also the sea-coasts (Malayan Peninsula and Islands), and may in calm weather be seen floating at a distance of two to three miles from the shore. Although numerous at Pinang and the opposite coast, it appears to be less so than *Crocodilus biporcatus* [i. e. *porosus*]. Fishermen while working the nets are not seldom attacked by crocodiles, and would, but for their presence of mind, oftener than they do, forfeit their lives. When seized they force their fingers into the eyes of the crocodile, which immediately lets go its victim, who is further rescued by his comrades. From 1842 to 1845 amputations from accidents of this description were unfortunately of no rare occurrence in the General Hospital at

Pinang. Individuals 15 ft. in length are not uncommon; some attaining to 20 ft. and upwards are reported to occur. In rivers a single one will often appropriate to himself a limited district, which, if it happens to be in the vicinity of a village, will soon be perceived in the loss of the grazing cattle. Instances of Malays, who, to avenge the loss of a relative, have watched the crocodile, and by diving from below plunged a kris into its heart, are on record. The eggs are white, the shell hard, of a cylindrical form, upwards of 3 in. in length, and about 1½ in. in diameter."

Hab. The British Museum Catalogue gives India, Ceylon, Burma, Malay Peninsula and Archipelago.

Order SQUAMATA.

Suborder LACERTILIA.

Family GECKONIDÆ.

28. GYMNODACTYLUS MARMORATUS (Kuhl).

Gymnodactylus marmoratus, Blgr. Cat. Liz. i. p. 44.

Of this species, which has not previously been recorded from the Malay Peninsula, I obtained one specimen on Penang Hill, at an elevation of 2000 feet, on 31st March 1898. Mr. Butler has since sent a specimen from Perak to the British Museum.

Colour (in life). Above warm yellowish brown with very rich dark brown markings, tail banded alternately light and dark. The small tubercles along sides of body show as white spots. Beneath purplish buff, tail yellowish mottled with dark brown. Iris a narrow red ring, remainder yellow, closely vermiculated with dark brown.

Size. Snout to vent 64 mm.; tail (end broken) 50 mm.

Hab. Malay Peninsula, Java, Sumatra, Borneo.

29. GYMNODACTYLUS PULCHELLUS (Gray).

Gymnodactylus pulchellus, Cantor, p. 25; Blgr. Cat. Liz. i. p. 46; S. Flower, P. Z. S. 1896, p. 863.

Localities. Penang Hills, 2000 to 2400 feet. Larut Hills, Perak, 3400 to 4400 feet. Singapore (*vide* British Museum Catalogue).

Habits. Nocturnal, usually living on rocks, sometimes entering houses. They bite fiercely when handled, and can give a sharp pinch.

Colour (in life). Upper surfaces light yellowish brown, with five dark rich brown bands, bordered with white, sulphur- or chrome-yellow. Upper surface of limbs uniform light yellowish brown like the back. Tail light brown (in young specimens nearly white), with sharply defined very dark brown rings; these may be as many as nine in number, and are about twice the width of the pale interspaces; the tip of the tail may be either white or dark brown. Under surfaces bluish buff. Iris golden brown.

Size. The largest I have measured were from Penang Hill.

♂. Total length 259 mm. (snout to vent 115; tail 144); this specimen had about 36 femoral and præanal pores in all. ♀. Snout to vent 100 mm.; tail reproduced.

Hab. Malay Peninsula; said to occur also in Bengal, and found in Tenasserim by Signor Fea.

30. GONATODES KENDALLI (Gray).

Gonatodes kendallii, Blgr. Cat. Liz. i. p. 63.

Gonatodes kendalli, S. Flower, P. Z. S. 1896, p. 863.

Kendall's Gecko is known from the Larut Hills in Perak, 4200 to 4600 feet (Mr. L. Wray), and I have obtained it in the same hills at 3400 feet. It is also found on Bukit Timah, Singapore, at under 500 feet elevation (Mr. H. N. Ridley).

Colour (in life). Above yellow, extensively marked with reddish brown, and with certain dark brown markings; tail alternately banded yellow and reddish brown. Below purplish grey, except tail, which is as above, but less distinct. Iris orange.

Hab. Malay Peninsula and Borneo.

31. GONATODES AFFINIS (Stol.).

Cyrtodactylus affinis, Stol. Journ. As. Soc. Beng. xxxix. 1870, p. 167, pl. x. fig. 1.

Gymnodactylus affinis, Blgr. Cat. Liz. i. p. 42; S. Flower, P. Z. S. 1896, p. 862.

Gonatodes penangensis, S. Flower, P. Z. S. 1896, p. 863, pl. xliv. fig. 1.

Gonatodes affinis, S. Flower, P. Z. S. 1898, p. 455.

This Gecko inhabits the caves among the granite rocks on Penang Hill, 2200 to 2400 feet above the sea. I also obtained a specimen in the Batu Caves, Selangor; it was a male and had *eight* præanal pores; it resembled the Penang specimens in colouring; the yellow bands across the upper surface were very bright and distinct, giving the Lizard a striking appearance.

Hab. Malay Peninsula.

32. ÆLUROSCALABOTES FELINUS (Gthr.).

Pentadactylus felinus, Günth. Rept. Brit. Ind. p. 117, pl. xii. fig. 8.

Ælurosaurus felinus, Blgr. Cat. Liz. i. p. 73.

Æluroscalabotes felinus, Blgr. op. cit. iii. p. 482.

This species, first described from a Singapore specimen, does not seem to have been again caught in the Straits Settlements.

In the Taiping Museum, in May 1898, I saw, but did not have time to examine, some interesting Geckoes which may perhaps belong to this or some allied species.

Hab. Malay Peninsula and Borneo.

33. PHYLLODACTYLUS SIAMENSIS Blgr.

Phyllodactylus siamensis, Blgr. P. Z. S. 1898, p. 918, pl. lv. fig. 1.

Localities. The first two specimens of this little Gecko were

from M. Pran and Hinlap: subsequently, in Nov. 1897, I caught two more under stones in the jungle near Hinlap (Dong Phya Fai), elevation about 700 feet.

Colour (in life). Above brown, spotted very strongly with black. Below grey, mottled with purple. Underneath of head brown. Labials marked with dark purplish brown and pale yellowish brown.

Size. Total length 86 mm. (snout to vent 42; tail 44).

Hab. Siam.

The three species of small House-Geckoes, *Hemidactylus frenatus*, *Hemidactylus platyurus*, and *Gehyra mutilata*, resemble each other in habits, and are collectively called, both by Europeans and natives, by onomatopoetic names:—

Siamese: "ching-chok."

Malay: "chichak" (pronounced "chee-chah").

34. HEMIDACTYLUS FRENATUS (Schleg.).

Hemidactylus frenatus, Cantor, p. 23; Stol. J. A. S. B. 1870, p. 104; Blgr. Cat. Liz. i. p. 120; S. Flower, P. Z. S. 1896, p. 865.

Localities. This seems the commonest House-Gecko throughout the Malay Peninsula and Siam; I have obtained it in the following places:—Penang, from sea-level up to 2260 feet elevation; Pulo Tikus (Rat Island) near Penang; Perak, from Matang (sea-level), Taiping, Kuala Kangsa, Ipoh and Batu Gajah; Selangor, from Kuala Lumpor; Johore, from Johore Bahru and from Dumdruan Estate, Gunong Pulai; Kedah, from Alor Star; Siam, from Bangkok, Ayuthia, Pakpreo, Pachim, Tahkamen, Bortong Kabin, and Chantaboon. I have not seen this species in Singapore, but Cantor records it from there, and there can be no reason why it should not be as numerous there as elsewhere. This Gecko was numerous on a boat in which we travelled for some weeks on the Bangpakong river, and I have also caught it at sea on board a steamer plying between Hongkong, Bangkok, Singapore, and West Australia, which helps to show how the species may have got its present wide distribution.

Habits. It frequents houses, gardens, and the open country (where it hides under stones during the daytime), but indoors it is by no means strictly nocturnal. If kept in confinement, it will eat mealworms readily.

Colour. The adult seems to have considerable power in changing its colour; usually it is buff or ashy brown, but I have seen individuals very dark brown, almost black. The markings also come and go, but a darkish-brown line on the side of the head, passing through the eye, is usually constant and edged with yellow above. The young (like those of *Gehyra mutilata*) are very prettily marked: the upper surface is brown with darker and lighter spots, a darker lateral line, tail ringed alternately dark brown and yellow; lower surface immaculate buff, except the tail, which may be coral-red.

Size. The largest specimens I have measured were:—

♂. From Borneo, total length 132 mm. (snt. to vnt. 64; tail 68).

♀. From Perak, total length 109 mm. (snt. to vnt. 55; tail 54). The width of the head in this specimen was 11 mm., and in a ♂ of about the same size 12·5 mm.

Hab. Southern India, Ceylon (I found this species very numerous in houses at Colombo), Andamans, Burma, Siam, Cambodia, China, Hainan, Formosa, Malay Peninsula, Nias, Java, Borneo (I found it at Kudat and Brunei), Philippines, Celebes, Lombok, Sumba, Savu, Ombaai, Ké Islands, North Australia, Amirantes, Mauritius, St. Helena, and Somaliland.

35. HEMIDACTYLUS BROOKII Gray.

Hemidactylus maculatus, part., Günth. Rept. Brit. Ind. p. 107.

Hemidactylus gleadovii, Blgr. Cat. Liz. i. p. 129; Blgr. Fauna Brit. Ind., Rept. p. 86 (figured); S. Flower, P. Z. S. 1896, p. 865.

Hemidactylus brookii, Blgr. Cat. Liz. i. p. 128; Blgr. A. M. N. H. 1898, i. p. 123.

Hab. India, Ceylon, Burma, South China, Malay Peninsula, Borneo, Ombaai, and Tropical Africa.

36. HEMIDACTYLUS DEPRESSUS Gray.

Hemidactylus depressus, Blgr. Cat. Liz. i. p. 134.

Hab. Ceylon, Malay Peninsula.

37. HEMIDACTYLUS LESCHENAULTI D. & B.

Hemidactylus leschenaultii, Blgr. Cat. Liz. i. p. 136.

Hab. India, Ceylon, Malay Peninsula.

38. HEMIDACTYLUS COCTÆI D. & B.

Hemidactylus coctæi, Cantor, p. 23; Blgr. Cat. Liz. i. p. 137.

Hab. India, Malay Peninsula.

These four species, *brookii*, *depressus*, *leschenaulti*, and *coctæi*, must be either very rare or local in the Straits Settlements; I have nothing to add to what is recorded of them in the P. Z. S. 1896, p. 865.

39. HEMIDACTYLUS PLATYURUS (Schneid.).

Nycteridium schneideri, Günth. Rept. Brit. Ind. p. 111.

Hemidactylus platyurus, Blgr. Cat. Liz. i. p. 143.

The Parachute House-Gecko was recorded from Penang by both Cantor and Stoliczka; it is apparently rare there now, as I have only met a single individual, in Georgetown, November 1896. In Singapore, however, it is very numerous in many houses, though curiously it does not seem to have been hitherto recorded from there. So far I have never seen it on the mainland of the Peninsula. In Siam we found it common in houses and gardens (and river-boats) in Bangkok, Ayuthia, Tahkamen, Paknam Kabin, Bortong

Kabin, and Chantaboon; and also received a specimen from Kosichang.

Colour (in life). As mentioned by Cantor, the young and adult are similarly marked and coloured, thus differing from the other common house species, i. e. *H. frenatus* and *Gehyra mutilata*. This species also seems to have but little power of changing its colour and so (irrespective of its parachute) can be easily identified when seen. Above grey, more or less mottled or speckled with yellowish brown, with quadrangular dark spots in pairs along the back, each pair being situated on a reddish-brown transverse band; tail with similar dark cross-bands. A dark line on each side of the head passing through the eye. Beneath bright lemon-yellow, pale yellow, or dirty white; tail sometimes is coral-red.

Size. The largest specimens I have measured were from Singapore:—♂. Total length 127 mm. (snt. to vnt. 61; tail 66). ♀. Total length 110 mm. (snt. to vnt. 55; tail 55).

Hab. India, Ceylon, Burma, Siam, Cambodia, South China, Malay Peninsula, Java, Borneo[1], Celebes, Savu, and Philippines.

40. MIMETOZOON CRASPEDOTUS (Mocquard).

Hemidactylus craspedotus, Mocq. Le Natur. 1890, p. 144.
Mimetozoon floweri, Blgr. P. Z. S. 1896, p. 767, pl. xxxvi. - S. Flower, P. Z. S. 1896, p. 866.
Mimetozoon craspedotus, Blgr. P. Z. S. 1898, p. 914.

Hab. Malay Peninsula, Borneo.

41. GEHYRA MUTILATA (Wiegm.).

Hemidactylus peronii, Cantor, p. 22.
Peripia peronii, Stol. J. A. S. B. 1870, p. 163.
Gehyra mutilata, Blgr. Cat. Liz. i. p. 148; S. Flower, P. Z. S. 1896, p. 866.

Localities. This House-Gecko is very common in Penang from sea-level to 2500 feet, and is the commonest species in Singapore. On the Peninsula, however, it does not seem so widely distributed as *Hemidactylus frenatus*; I have only seen it at Alor Star in Kedah, and at Matang (sea-level), Taiping, and Maxwell's Hill (3400 feet) in Perak. I have also found it in on the little island of Pulo Tikus, near Penang. Possibly it has but recently extended to Siam; for though it does not seem to have been previously recorded from there, I found it numerous in houses in Bangkok and Chantaboon, but in both places less so than either *H. frenatus*, *H. platyurus*, or *Gecko verticillatus*, and I never saw it up country, where these three other species were common.

Colour (in life). Adult: usually buff or grey, sometimes nearly white, generally immaculate, but sometimes on the upper surfaces dotted or variegated with darker. Young: upper surfaces yellowish brown (but varies from light yellow to rich purplish brown at different times in the same individual), profusely and distinctly

[1] I obtained this species in Brunei.

marked with larger dark brown or black spots and smaller pale yellow spots; the latter are edged with a narrow dark brown ring and may form four fairly regular longitudinal lines, two of larger yellow spots along the back and one of smaller spots along each side. A dark line on either side, commencing at the snout, passing through the eye, and continuing to the inset of the hind leg; on either side of the head above this dark line is a very distinct line of pale (or bright) yellow spots. The superior margin of the orbit is bordered with minute pale yellow spots. The lips are spotted alternately pale (or bright) yellow and dark brown. Lower surfaces immaculate, varying in colour from pale buff to grey or purplish brown. Sometimes the colour of the upper and lower surfaces do not merge into each other, but join in a well-defined line along the sides of the neck, body, and limbs. Tail ringed with broad dark brown bands, separated by narrow pale yellow interspaces. Iris golden.

Size. Males and females attain the same length, 120 mm. Snout to vent 60 mm. Length of tail 60 mm. Width of head 12 mm. The very depressed tail may measure at its broadest part a quarter of its length.

Hab. Ceylon, Burma, Siam, Malay Peninsula, Sumatra, Borneo (where I met it at Brunei), Celebes, Sumba, Ombaai, Philippines, Timor Laut, New Guinea, Mascarene Islands, Seychelles, and Western Mexico.

42. LEPIDODACTYLUS CEYLONENSIS Blgr.

Lepidodactylus ceylonensis, Blgr. Cat. Liz. i. p. 164, pl. xiii. fig. 3; S. Flower, P. Z. S. 1896, p. 867.

I caught a second specimen in Government House, Singapore, in October 1897. Total length 60 mm. (snt. to vnt. 32; tail 28).

Colour. Very similar to the first Singapore specimen.

Hab. Ceylon, Burma, Malay Peninsula, Engaño, Java, Borneo.

43. LEPIDODACTYLUS LUGUBRIS (D. & B.).

Platydactylus lugubris, Cantor, p. 16.
Peripia cantoris, Günth. Rept. Brit. Ind. p. 110.
Lepidodactylus lugubris, Blgr. Cat. Liz. i. p. 165.

Not recorded from the Straits Settlements since Cantor's time.

Hab. Malay Peninsula, Bintang, Celebes, Amboyna, New Guinea, and Polynesia.

44. GECKO VERTICILLATUS (Laur.).

Platydactylus gecko, Cantor, p. 17.
Gecko guttatus, Günth. Rept. Brit. Ind. p. 102.
Gecko verticillatus, Blgr. Cat. Liz. i. p. 183.
"Toké" of the Malays (*apud* Cantor).
Siamese. "Tokay."

Localities. The Great House-Lizard or Tokay is recorded from Penang, Singapore, and the Malay Peninsula, but it must be very

rare or local; I have not met it myself there, nor remember meeting any Englishman who had seen it for certain, but men have told me they have heard it in parts of Perak and Pahang. In Siam, however, it is one of the commonest animals that attracts the attention of everybody, however unobservant or indifferent to natural history: I have met it in Bangkok, Ayuthia, Pakpreo, Patriew, Pachim, Tahkamen, and Chantaboon.

Habits. The Tokay is very numerous both in towns and country in Siam, almost every house is inhabited by one or more, and they do not shun the busiest places; for instance, two or three of these striking lizards are to be seen any evening in either the Club or Oriental Hotel in Bangkok, playing and feeding on the walls, perfectly indifferent to the buzz of conversation and click of billiard-balls. Each Tokay usually has its particular hole or crevice which it sleeps in regularly every day, and retires to at any time if frightened. It gets its popular name from its remarkable loud call. Each call consists of, 1st, one "preliminary cackle" (or sometimes two); 2nd, the word *to-kay* very distinctly and deliberately pronounced and repeated usually six, seven, or eight times, though I have counted it eleven times. This cry of "tokay" can be distinctly heard at 120 paces (approximately 100 yards) from the spot where the lizard is calling. Besides this well-known loud call, the Tokay when alarmed or angry can make a strong hissing or puffing noise in a threatening manner, at the same time blowing the sides of its body in and out and opening its mouth wide ready to bite.

The Tokay (in Bangkok) commences calling in December; the 5th is the earliest date I have heard it, but it does not become usual till the latter part of the month. In January it is to be heard at intervals almost every evening, especially towards the end of the month. In February it is more frequent at night and occasionally to be heard during the day. In the hot weather of March, April, and May it is often to be heard calling all night long, in one direction or another; in the old Wang Na (2nd King's Palace) in Bangkok, on particularly hot nights, the noise of "tokay, tokay" was almost continuous, one lizard after another taking up the cry; at this season, too, it is not unusual to hear one calling in the morning or at midday. In June it becomes much quieter, till in the first half of July often only one will be heard during a whole evening. In 1897 the last Tokay heard calling that I have a note of was on July 20th, in 1898 July 17th, and once again on August 14. During the autumn, so far as my experience goes, it remains mute and begins again in December.

The little house-lizards (*Hemidactylus frenatus*, *H. platyurus*, and *Gehyra mutilata*), though, are almost as noisy in July and November as in the spring; their cry of "tok, tok, tok," repeated five to eight times with increased celerity, is a very different thing to the resonant, measured call of *Gecko verticillatus*.

In March 1897, in the jungle to the south of Tahkamen, in Eastern Siam, I heard the ordinary preliminary cackle of this

lizard, but instead of following it with "to-kay," it shouted "tuk-tu, tuk-tu" several times. I could not see anything, so do not know whether the author of the cry was *Gecko verticillatus* or not, but I have seen it stated in books that the call of *G. verticillatus* (at any rate in Burma) is "tuk-tu."

When caught the Tokay, young or old, tries hard to defend itself by biting. It is of a bold and inquisitive nature. One day I held up the lash end of a cutting-whip to one looking out of a hole in the wall, and moved the lash about: this interested him very much; he came right out after it and seized it in his mouth, so I let go, and while against the smooth vertical wall the lizard supported the whole weight of the whip in his mouth, but after an unsuccessful attempt to drag it into his hole, he gave up and dropped it.

I am afraid the Tokay, besides its regular food of insects, eats the smaller house-geckoes and its own young, for, though I have never actually seen one do so, specimens of *Hemidactylus frenatus*, *Gehyra mutilata*, and young *Gecko verticillatus* which I have placed in the same glass case as an adult Tokay generally disappeared in a day or two, and there was no hole by which they could have got out of the cage. A Tokay has been seen to catch and eat a mouse, and it is supposed they catch small birds in trees at night.

The Tokay falls a victim at times to the Green and Black Tree-Snake, *Chrysopelea ornata*, but not without a prolonged struggle. Several instances of this have come before my notice. In one a snake 1459 mm. long eventually swallowed a Tokay 311 mm. long, after some hours of fighting; most of the time each animal held the other firmly in its jaws, and so intent were they, that they were caught and carried indoors without letting go their hold. Another time a snake 1243 mm. long had a similar encounter with a full-grown Tokay. This took place in the yard of my house at Bangkok; eventually the lizard seemed to grow quite stupefied or paralyzed, and fell an easy prey to the snake.

Popular beliefs.—It is not surprising that many properties are attributed to an animal like the Tokay; even some Europeans believe not only that its bite is fatal, but that the "suction" of its fingers causes painful blisters on the human skin. When a new house is built, its inhabitants anxiously look out for the appearance of a Tokay in it, and from various causes, such as the number of days since the house was finished, or the number of times it calls, they predict such and such a fortune to the house and its inmates; as far as I can make out, the general idea is that the sooner the Tokay makes its appearance the better luck is in store. And in most affairs of life the Siamese attach importance to the cry of the Tokay: thus apparently for a Tokay to call at the birth of a child is good luck, and the oftener it repeats "to-kay" the better.

It also affords the natives a simple form of gambling which requires no apparatus: the stakes and rules having been arranged among the party, they just sit still and wait till a Tokay cries the winning number.

Many people have heard how a hill-fort in India, long supposed to be impregnable, was captured by means of a lizard which went up the perpendicular rock-face, with a cord attached to it, by means of which the attacking soldiers eventually ascended. In Bangkok *it is said* that people's hats are stolen by means of the Tokay. The lizard, with a cord round its body, is let down at night from a roof or veranda over the head of a passer-by in the street; it struggles to find a foothold, touches the hat, seizes it, and next moment is jerked up by the man, watching above, cord in hand, and the astonished victim is at a loss to know whither his hat has suddenly vanished.

Colour (in life). Upper surface and sides of head, body, and limbs grey (varying from pale bluish to very dark rich violet), profusely spotted; the spots are either very pale bluish grey, almost white, or rich brick-red. On the head these spots are fairly symmetrically arranged, the red ones predominate, and the light ones are not so whitish as they are on the body; these latter on the top of the head coalesce more or less into longitudinal lines. On the back the light spots are grouped into narrow transverse bands; usually there is one of these on the neck, one on the shoulders, four between the limbs, and one on the loins. The spots on the limbs are smaller than those on the back, red and light grey, subequal in size and in about equal numbers. The upper surfaces of the digits are similarly marked, the spots being smaller than on the limbs. The nails are pale blue-grey, like the light spots.

Lower surface of head, body, and limbs paler grey than above, whitish on the chin, spotted as above, but the spots are smaller, paler in colour, and not so sharply defined. The lower surfaces of the digits are brownish grey. Tail grey (usually darker than the back, and in young specimens dark violet, almost black), with about eight narrow transverse rings of pale bluish grey (in young specimens almost white). Iris yellow.

Size. The largest specimen I have measured, a male from Bangkok, was snout to vent 178 mm., and width of head 45 mm.; it had lost its tail, which, judging from other specimens, should have been nearly as long as the head and body, which would give the total length of an adult Tokay to be about 356 mm.

Hab. North-eastern India, Burmah, South China, Annam, Siam, Malay Peninsula, Java, Celebes, Lombok, Ombaai, Savu, Sulu Island, Philippines, Timor Laut.

45. GECKO STENTOR (Cant.).

Platydactylus stentor, Cantor, p. 18.

Gecko smithii, Stol. J. A. S. B. 1870, pp. 161, 162.

Gecko stentor, Günth. Rept. Brit. Ind. p. 102, pl. xi. fig. A; Blgr. Cat. Liz. i. p. 184.

Recorded from Penang by Cantor and Stoliczka.

Hab. Burma, Andamans, Malay Peninsula, Sumatra, Java, Borneo.

46. GECKO MONARCHUS (Schleg.).

Platydactylus monarchus, Cantor, p. 19.
Gecko monarchus, Blgr. Cat. Liz. i. p. 187; S. Flower, P. Z. S. 1896, p. 868.

Very common in certain houses in Singapore, and I have seen one specimen from the Province Wellesley.

Colour (in life). Pale greyish brown, above with very dark brown spots arranged in a symmetrical pattern, below immaculate.

Size. The two largest individuals I have measured were respectively:—

Total length .... 194 mm. (snt. to vnt. 77; tail 117).
„ „ .... 182 mm. („ „ 84; „ 98).

Hab. Ceylon, Malay Peninsula, Sumatra, Nias, Borneo, Celebes, Philippines, Mysol, Amboyna.

47. PTYCHOZOON HOMALOCEPHALUM (Crev.).

Ptychozoon homalocephalum, Cantor, p. 20; Stol. J. A. S. B. 1870, p. 159; (part.) Blgr. Cat. Liz. i. p. 190; Blgr. Fauna Brit. Ind., Rept. p. 104 (fig. p. 105).

The "Flying Gecko" has been recorded from Penang by Cantor and Stoliczka; I have also obtained one individual there myself at about 2200 feet elevation. Either this or the next species is found in Perak; I have seen a specimen from Ipoh, in that State.

Colour (in life). Cantor's description is very good, but where he writes "white" and "whitish" my Penang specimen was *bright lemon-yellow* and *yellowish*. Tongue and inside of mouth are lilac-grey.

Size. The above mentioned specimen from Penang, a female, measured:—

Total length 128 mm. (snout to vent 65; tail 63).
Width of head (exclusive of dermal flaps) 14·5 mm.
Extent across fully extended parachute 34 mm.

Hab. Burma, Malay Peninsula, and some islands of the Archipelago.

48. PTYCHOZOON HORSFIELDI (Gray).

Ptychozoon homalocephalum (part.), Blgr. Cat. Liz. i. p. 190.
Ptychozoon horsfieldi, S. Flower, P. Z. S. 1896, p. 868.

Horsfield's "Flying Gecko" has been recorded from Penang and Singapore. F. Müller (Verh. nat. Ges. Basel, 1892, p. 210) pointed out how *P. horsfieldi* differs from *P. homalocephalum*; these points may be summarized as follows:—

1. The tail has no large rounded flap at the extremity, but gets gradually narrower from the base to the tip. There are 18 lobes on each side, which are directed backwards instead of standing at right angles.

2. There are three equal-sized enlarged shields over the first three upper shields.
3. The ear-opening is not subcircular, but a triangular long slit with the apex pointing downwards.
4. No enlarged tubercles on the back.
5. The ♂ has 38 pores in all, 10 præanal arranged in a chevron, and 14 femoral on each side, with an interval of 8 ordinary scales separating them. Boulenger describes *P. homalocephalum* as having "an angular series of about 25 præanal pores."
6. The ground-colour is reddish brown throughout, several broad distinct black cross-bands on the back and tail.

Hab. Malay Peninsula and some islands of the Archipelago.

Family Agamidæ.

49. Draco volans L.

Draco volans, Cantor, p. 38; Blgr. Cat. Liz. i. p. 256, S. Flower, P. Z. S. 1896, p. 868.

"Chichak terbang" or "Kubin" of the Malays (*apud* Cantor).

The common Flying Lizard is known from Kedah, Penang, Province Wellesley, the Dindings, Malacca, and Singapore.

Size. Two males caught in Penang in 1898 measured:—

Total length 199 mm. (snt. to vnt. 80; tail 119).
„ „ 235 mm. („ „ 78; „ 127).

Hab. Malay Peninsula (extending into Lower Siam), Sumatra, Nias, Sipora (Mentawei Islands), Java, Borneo.

50. Draco maculatus Cantor.

Draco maculatus, Cantor, p. 39; Blgr. Cat. Liz. i. p. 262.
Draco haasii, Boettger, Zool. Anz. 1893, p. 429.

The Spotted Flying Lizard was obtained by Cantor in the hills of Penang, and by M. Mouhot in Pachebone and Cambodia.

D. haasii was founded on two lizards obtained by the late Dr. Erich Haase on the trunks of trees near the Phrachadee of Kau Sabap, Chantaboon, Siam. The type specimen is now in the Frankfort Museum, and the second in the British Museum. Mr. Boulenger writes that he does "not consider it to be specifically distinct from *D. maculatus*."

Hab. Assam, Burma, Siam, Cambodia, Pulo Condore, Malay Peninsula.

51. Draco fimbriatus Kuhl.

Draco fimbriatus, Blgr. Cat. Liz. i. p. 265.

Only two specimens are recorded from the Straits Settlements (*vide* P. Z. S. 1896, p. 870).

Hab. Malay Peninsula, Sumatra, Java, Borneo.

52. Draco quinquefasciatus Gray.

Draco quinquefasciatus, Blgr. Cat. Liz. i. p. 269, pl. xx. fig. 8.

Besides the two specimens recorded from the Straits Settlements (P. Z. S. 1896, p. 870), Dr. Hanitsch records it from Selangor (Rep. Raffles Libr. & Mus. 1897, p. 9).

Hab. Malay Peninsula, Borneo.

53. Draco tæniopterus Günth.

Draco tæniopterus, Blgr. Cat. Liz. i. p. 269.

The type specimen collected by M. Mouhot was from Chantaboon, where the late Dr. E. Haase also obtained it (Boettger, Zool. Anz. 1893, p. 430). I have examined five individuals from there.

Sex	♂.	♂.	♀.	♀.	Immature.
Total length	185	200	242	190	170 mm.
Snout to vent	75	69	74	65	55 mm.
Tail	110	131	168	125	115 mm.
No. of upper labials	8	9	9+10	8+9	9

Hab. Siam and Tenasserim.

54. Draco melanopogon Blgr.

Draco melanopogon, Blgr. Cat. Liz. iii. p. 492.

Originally described from Malacca. Dr. Hanitsch records it from Singapore (Rep. Raffles Libr. & Mus. 1897, p. 9).

Hab. Malay Peninsula, Borneo, Natunas.

55. Aphaniotis fusca Peters.

Aphaniotis fusca, Blgr. Cat. Liz. i. p. 274.

Hab. Malay Peninsula (2 specimens from Malacca in Brit. Mus.), Borneo, Natunas.

56. Gonyocephalus herveyi Blgr.

Gonyocephalus herveyi, Blgr. Cat. Liz. iii. p. 493.

Hab. Malay Peninsula (1 specimen from Malacca in Brit. Mus.), Natunas.

57. Gonyocephalus borneensis (Schleg.).

Gonyocephalus borneensis, Blgr. Cat. Liz. i. p. 288.

Recorded from Malacca (Blgr. Cat. Liz. iii. p. 493), and from Maxwell's Hill, Perak, elevation 3600 feet (Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 9).

Hab. Malay Peninsula and Borneo.

58. Gonyocephalus grandis (Gray).

Dilophyrus grandis, Cantor, p. 34, pl. xx.

Gonyocephalus grandis, Blgr. Cat. Liz. i. p. 298.

Not recorded from the Straits Settlements since Cantor's time.

Hab. Burma, Malay Peninsula, Sumatra, Sipora (Mentawei Islands), Borneo.

59. ACANTHOSAURA CAPRA Günth.

Acanthosaura capra, Blgr. Cat. Liz. i. p. 300.

Only known from the type specimens collected by M. Mouhot at Chantaboon, and now in the British Museum.

Hab. Siam.

60. ACANTHOSAURA ARMATA Gray.

Lophyrus armatus, Cantor, p. 32.

Acanthosaura armata, Blgr. Cat. Liz. i. p. 301, pl. xxii. fig. 1.

Of this remarkable-looking lizard I obtained two specimens during March and April, 1898, in Penang, one in a valley and one at 2200 feet elevation in the hills. Cantor writes of it—"At Pinang this species appears to be very local, and not numerous; two individuals were obtained from spice plantations in the valley. They were very active and fierce, possessed in a slight degree the power of changing the ground-colour to a light hue, and in captivity refused food and water." One specimen I kept alive for a short time, however, seemed to have considerable power of changing its colours. The male when angry distends its gular pouch.

In the British Museum are specimens from Gen. Hardwicke's collection labelled Singapore; but one cannot help feeling doubtful of some of the localities of Hardwicke's specimens, and it seems strange that in an island so well known as Singapore, and constantly visited by collectors, this lizard should not have been again secured.

M. Mouhot obtained *A. armata* at Chantaboon, and I have seen a specimen that was shot there in July 1896.

Colour (in life). Upper surfaces—head chestnut, remainder blackish green, a transverse black band in the interval between the cervical and dorsal crests, continued forward over the shoulders; body, limbs, and tail with numerous spots, some of which are clear sky-blue; about seven black lines radiate from the eye. Lower surfaces yellow, tinged with reddish-orange on the chest. Gular pouch pale lilac, in the male. Tongue and inside of mouth bright orange-colour. Iris brown with a narrow golden ring.

Size. The Chantaboon specimen when stuffed measured 236 mm. in total length (snt. to vnt. 110; tail 126). The Penang ones when fresh were:—

Sex	♂.	♀.
	mm.	mm.
Total length	208	259
Snout to vent	91	116
Tail	117 (tip broken)	143
Supraocular spine	9·25	9·5
Supertympanic spine	9·3	8·2
Longest nuchal spine	11	11

Hab. Tenasserim, Siam, Cochinchina, and Malay Peninsula.

61. ACANTHOSAURA CORONATA Günth.

Acanthosaura coronata, Blgr. Cat. Liz. i. p. 303.

Only known from the type specimens collected by M. Mouhot in Chantaboon, now in the British Museum.

Hab. Siam.

62. CALOTES CRISTATELLUS (Kuhl).

Bronchochela cristatella, Cantor, p. 30.

Calotes cristatellus, Blgr. Cat. Liz. i. p. 316; S. Flower, P. Z. S. 1896, p. 871.

"Gruning" of the Malays of the Peninsula (*apud* Cantor).

"Sumpah-sumpah" } These are the Malay names I have heard
"Pookah" } applied to this Lizard, and also to *Calotes versicolor*.

Localities. Of this fine lizard, commonly called "Chameleon" by the English in the Straits Settlements, I have seen specimens from Penang (up to 2200 feet), Perak, Selangor, and Singapore; wherever it occurs it seems to be fairly numerous. Dr. Hanitsch records it also from Kemaman (Rep. Raffles Libr. & Mus. 1879, p. 9).

Description. There may be as many as 121 scales round the middle of the body.

Colour. To my previous account of the changes of colour of this species (P. Z. S. 1896, p. 871) may be added:—

1st. Iris, in different individuals, may be rich bright carmine-red, hazel-brown, or dark brown.

2nd. In one phase of colour the head, nuchal crest, body, limbs, and anterior portion of tail are bright grass-brown, with six indistinct dark green transverse bands on the body, and the posterior portion of tail dark brown.

Hab. Tenasserim, Malay Peninsula, Sumatra, Nias, Sipora (Mentawei Islands), Java, Borneo, Celebes, Philippines, Ceram, Mysol, Timor Laut.

N.B.—CALOTES SMARAGDINUS (Günth.).

Calotes smaragdinus, Blgr. Cat. Liz. i. p. 319.

This lizard is known from Cambodia, where the types were obtained by M. Mouhot, so it may possibly also occur in Siam.

Hab. Cambodia.

63. CALOTES MICROLEPIS Blgr.

Calotes microlepis, Blgr. Ann. Mus. Genova, (2) v. 1887, p. 476, pl. vi. fig. 1.

Of this species, which has not before been recorded from Siam, I obtained one specimen from Chantaboon.

Hab. Tenasserim, Siam.

64. CALOTES VERSICOLOR (Daud.).

Calotes versicolor, Blgr. Cat. Liz. i. p. 321; Blgr. Fauna Brit. Ind., Rept. p. 135, fig. p. 136; S. Flower, P. Z. S. 1896, p. 872.

Siamese. "King-kar."

The Indian Changeable Lizard, known as the "Chameleon" by the English in Siam and as the "Bloodsucker" in Ceylon, does not seem to extend to the southern portion of the Malay Peninsula, though it is numerous in Kedah (both at Alor Star and at Kulim) and fairly common in Penang near sea-level, and I have obtained one specimen in the hills there at an elevation of 2200 feet. Dr. Hanitsch records a specimen from the Province Wellesley (Rep. Raffles Libr. & Mus. 1897, p. 9).

In Siam this is the commonest Agamoid; there are specimens in the British Museum from Pachebone collected by M. Mouhot, and I have met the species in Bangkok, Ayuthia, Pakpreo, Hinlap (Dong Phya Fai, elevation 700 feet), Tahkamen, Kabin, Chantaboon, and on the island of Kosichang.

Description. In Siamese specimens I have counted from 42 to 57 scales round the middle of the body.

Colour (in life). Upper surfaces nearly uniform pale brown (either greyish, olive, yellowish, or rufous), with five to seven more or less distinct darker brown transverse bands on the back (these sometimes do not meet symmetrically in the centre line of the back), which are interrupted by a more or less strongly defined light (white, buff, or bright yellow) dorso-lateral longitudinal line (about 1½ to 2 scales wide) on each side, which line reaches from the neck to the tail, where it gradually disappears; these light longitudinal lines may be bordered above and below by very narrow black lines. The upper surfaces of the limbs and digits are cross-barred with brown. The tail is frequently ringed with dark brown, the dark rings being nearly black anteriorly and about twice the width of the pale interspaces. Lower surfaces very pale buff, frequently with faint darkish longitudinal lines on the neck, down the centre of the abdomen, and under the thighs.

A noticeable and apparently constant feature of this species is the dark lines radiating from the eye, and the top of the head is more or less marked.

Typical Bangkok specimens have well-defined rich dark brown markings on the head, as follows:—

A faint chevron (pointing backwards) on the snout, 3 indistinct cross-bars on the forehead, two fine crescentic lines (pointing backwards) joined by a transverse line behind the eyes, a pair of black spots on the nape (with a very small white spot in the centre and another outside each); both upper and lower labials alternately light and dark; 9 lines radiate from the eye, one goes forwards and downwards to the upper labials, another goes backwards and downwards to the upper labials and is continued in the same direction on the lower jaw, another is directed to the tympanum, another is directed backwards and upwards and converges with its fellow on the opposite side, meeting on the back of the neck at about the eighth nuchal spine; there is another cross-bar on the neck at about the twelfth nuchal spine.

The *gular pouch* at certain times of year (noted in May [Kedah] and in November [Hinlap]) is very conspicuous, eing white, or

white speckled with red; so far as I have observed, it is only in the males that the pouch becomes distended. In January [Chantaboon] the males had the head, neck, upper arms, and fore part of the body diffused with bright red, which gave them a striking appearance. In spirits the gular pouch becomes hardly noticeable. Iris reddish brown. Inside of mouth flesh-colour.

Size. The largest individuals of their respective sexes, out of a large series that I have measured, are:—

♂ from Alor Star, Kedah. Total length 376 mm. (snt. to vnt. 95; tail 281).

♀ from Sepoy Lines, Penang. Total length 332 mm. (snt. to vnt. 86; tail 246).

The nuchal spines attain a length of 5·2 mm.

Hab. Afghanistan, Beloochistan, India, Ceylon, Burma, Siam, South China, Malay Peninsula.

65. CALOTES EMMA Gray.

Calotes emma, Blgr. Cat. Liz. i. p. 324, pl. xxv. fig. 1.

I have obtained one specimen from Chantaboon. Also a lizard, said to have been caught in Bangkok, ♂, total length 296 mm. (snt. to vnt. 84; tail 212), with about 72 scales round the middle of the body, which I sent to the British Museum, "appears to be an abnormal *C. emma*," on the authority of Mr. Boulenger.

Hab. Burma, Siam.

66. CALOTES MYSTACEUS D. & B.

Calotes mystaceus, Blgr. Cat. Liz. i. p. 325.

M. Mouhot obtained a specimen in Cambodia, and I received two from Chantaboon.

Hab. Ceylon, Burma, Nicobars, Siam, Cambodia.

67. PHYSIGNATHUS MENTAGER Günth.

Physignathus mentager, Günth. Rept. Brit. Ind. p. 153, pl. xv.; Blgr. Cat. Liz. i. p. 400.

Siamese. "King-kar-kong."

This fine lizard was described from a specimen obtained at Chantaboon by M. Mouhot, who also got the species at Pachebone. I received one from Chantaboon, and though the tip of the tail was broken off it measured in total length 620 mm. (snt. to vnt. 250; tail 370); it had eleven enlarged shields on either side of the throat.

In the Siamese Museum is a rather smaller specimen with ten enlarged shields on either side of the throat.

Hab. Siam.

N.B.—PHYSIGNATHUS COCHINCHINENSIS (Guérin).

Physignathus cochinchinensis, Blgr. Cat. Liz. i. p. 399.

This lizard is known from Cochinchina, so may possibly also occur in Siam. A lizard in the Siamese Museum, labelled by

Dr. E. Haase "*Physignathus cochinchinensis*, Siam," I consider to be really *P. mentager*.

Hab. Cochinchina.

68. LIOLEPIS BELLII (Gray).

Liolepis bellii, Cantor, p. 41; Blgr. Cat. Liz. i. p. 403.
Liolepis belliana, Blgr. Fauna Brit. Ind., Rept. p. 156.
Liolepis guttatus, W. Davison, J. S. B. R. A. S. 1889, pp. 88 & 190.
Siamese. "Tooa-yaa."

For brilliancy and beauty of colour few animals can vie with this lizard. Although Cantor was such an admirable observer of natural history, it seems probable that when he wrote of this lizard "leaping from branch to branch," it was conjecture or what he had been told of its habits, and not what he had actually seen; for, on the authority of Theobald and Davison, we know that it is terrestrial and a burrower, and Mr. Ridley has told me the same and also that it frequents sandy localities, where it makes its burrows. Personally, I have not seen its burrows, but when coming on an individual among a grove of bushes it made off by running on the ground, instead of climbing into a bush as the arboreal Agamoids do. It is diurnal, and in spite of its rather heavy build can run very quickly (as Cantor also remarked). Some classes of Siamese and Laos eat this lizard, and esteem it a delicacy.

Localities. Province Wellesley (*Cantor*), Kalantan and on the Rumpin River in Pahang (*Davison*); and I have seen specimens from three places in Siam—Pakpreo, Anghin, and Chantaboon.

Colour (in life). The following description is of a specimen from Pakpreo (which, it will be seen, differs somewhat from Cantor's Province Wellesley specimens):—

Upper surface of head, neck, body, and limbs yellowish olive-green, a few small yellow spots on the neck; the back has very distinct black-ringed, round, bright yellow spots, on the posterior part of the body these spots coalesce to form a dorso-lateral line of yellow and black; the fore limbs are indistinctly spotted with yellow and orange, the hind limbs very distinctly spotted with yellow. The sides of body are rich dark blue, with about eight large and several small bright orange-red spots; below the dark blue and orange the sides are bright lemon-yellow, which merges gradually into the pale grey of the belly. Lips and sides of head pale blue-grey, with very faint orange spots. The underneath of head, neck, body, and limbs very pale blue-grey. On the fore part of the thigh and on the upper surface of the foot are patches of bright cobalt-blue. Tail yellowish olive-green above, with numerous minute yellow spots; the sides are a lighter, brighter green and immaculate; the lower surface is very pale yellowish green.

Size. The Pakpreo specimen, above described, measured in total length 338 mm. (snt. to vnt. 120; tail 218). A specimen from Anghin was larger, having snout to vent 152 mm., but a broken tail.

Hab. Southern India, Burma, Southern China, Siam, Cambodia, Malay Peninsula.

N.B.—Cantor adds to his account of *L. bellii*: "There seems to be reason to believe that *Leiolepis reevesii*, Gray, inhabiting 'China' and Arracan, is also found on the Malayan Peninsula."

L. reevesii is now included as a synonym of *L. bellii*, vide British Museum Catalogue Liz. i. p. 403.

Family Varanidæ.

69. Varanus flavescens (Gray).

Varanus flavescens, Blgr. Cat. Liz. ii. p. 309.

One specimen recorded from Penang (Cantor, p. 28).

Hab. Northern India, Burma, Malay Peninsula.

70. Varanus nebulosus (Gray).

Varanus nebulosus, Blgr. Cat. Liz. ii. p. 311.

Recorded from Penang Hills (Cantor, p. 27), Malacca (Blgr. Cat. Liz. iii. p. 505), and Singapore (Hanitsch, Rep. Raffles Libr. & Museum, 1897, p. 9).

I received a specimen from Petchaburee, Siam; it measured, snout to vent about 255 mm., the tail was broken. The native who obtained it said its Siamese name was "takoat."

Hab. Bengal, Burma, Siam, Malay Peninsula.

71. Varanus rudicollis Gray.

Varanus rudicollis, Blgr. Cat. Liz. ii. p. 313.

Recorded from Malacca (Blgr. Cat. Liz. iii. p. 505).

Hab. Malay Peninsula, Borneo, Philippines.

72. Varanus salvator (Laur.).

Hydrosaurus salvator, Günth. Rept. Brit. Ind. p. 67, pl. ix. fig. E.

Varanus salvator, Cantor, p. 29; Blgr. Cat. Liz. ii. p. 314; Blgr. Fauna Brit. Ind., Rept. p. 166 (head fig. p. 162); S. Flower, P. Z. S. 1896, p. 873.

Siamese. "Hee-air."

"Beyáwak" of the Malays (*apud* Cantor).

"Bey-wah" of the Malays, as commonly pronounced.

"Iguana" of the English in India, Siam, and the Straits Settlements.

This great Water-Lizard is very numerous in suitable localities throughout the Malay Peninsula and Siam. Cantor records it from Penang. I have met it in Kedah, Perak, Singapore, on the Menam river (Bangkok and Ayuthia), and on the Bangpakong river (Patriew, Pachim, and Harttachang). It is recorded from Pahang (H. J. Kelsall, J. S. B. R. A. S. 1894, p. 34, and R. Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 9); and there are

stuffed specimens in the Siamese Museum from Prachai and Angtong.

Hab. Ceylon, Nepal, Bengal, Burma, Siam, China, Malay Peninsula, Sumatra, Java, Borneo (where I obtained specimens from Kudat), Celebes, Lombok, Flores, Sumba, Philippines, and Cape York, N. Australia.

Family Lacertidæ.

Tachydromus sexlineatus Daud.

Tachydromus sexlineatus, Blgr. Cat. Liz. iii. p. 4.

This lizard, which has been recorded from both Burma and Cochinchina, will probably be eventually found in Siam.

Hab. Sikhim, Assam, Khasi Hills, Burma, South China, Cochinchina, Java, Borneo, and possibly Japan.

Family Scincidæ.

The Skinks present more difficulties in identification than the other families of East-Indian lizards, owing to the large number of closely allied species and to the varieties of colours in different individuals of some of the species; moreover, they are more difficult to collect owing to their extreme agility, and the naturalist who wishes to do so and to observe their habits must be prepared to remain motionless, while he watches them, sometimes for hours, under a scorching tropical sun. *Mabuia multifasciata* and *M. siamensis* are particularly sun-lovers, preferring to bask and play in the hottest spots; *Lygosoma bowringii*, however, is crepuscular, and *L. chalcides* a burrower. Some species frequent the sea-shore between tide-marks, *Lygosoma atrocostatum* I found on a rock which was covered at high water, and *L. parietale* we found on the coast of Brunei, Borneo, on the mud of the mangrove swamps; we saw large numbers of this species, which, when running, carries its tail raised in a stiff curl over the back, a peculiarity I have not observed in any other skink. As a rule skinks avoid water, but *Mabuia multifasciata*, to avoid capture, will readily plunge into a stream or pond and swim away.

73. Mabuia novemcarinata (And.).

Mabuia novemcarinata, Blgr. Cat. Liz. iii. p. 179.

Recorded from Penang (S. Flower, P. Z. S. 1896, p. 873).

Hab. Burma, Malay Peninsula.

74. Mabuia macularia (Blyth).

Mabuia macularia, Blgr. Cat. Liz. iii. p. 182.

M. Mouhot obtained this Skink in Cambodia, and I received three specimens from Kosichang, Gulf of Siam; the largest measured 141 mm. in total length (snt. to vnt. 61; tail 80).

Hab. Central and North-eastern India, Burma, Siam, Cambodia,

75. MABUIA RUGIFERA (Stol.).

Mabuia rugifera, Blgr. Cat. Liz. iii. p. 184.

Of this handsomely marked and remarkably scaled species, which has not previously been recorded from the Malay Peninsula, I obtained one specimen near the entrance of the Batu Caves, Selangor, in June 1898, and one in the jungle on Bukit Timah, Singapore, in Sept. 1898. In the latter the sides and underneath of the head and neck were a beautiful orange-red in life; it measured 182 mm. in total length (snt. to vnt. 56, tail 126).

Hab. Nicobars, Malay Peninsula, Nias, Sipora (Mentawei Islands), Java, Borneo.

76. MABUIA MULTIFASCIATA (Kuhl).

Euprepes rufescens, Cantor, p. 46.

Mabuia multifasciata, Blgr. Cat. Liz. iii. p. 186; S. Flower, P. Z. S. 1896, p. 874.

Siamese. "Ching-lane."

Malay. "Menkarong" and "bengkarong."

Localities. This is the common "Sun Lizard" or "Grass Lizard" of the Straits Settlements and is also very numerous in parts of Siam. I have met it in Kedah (Alor Star and Jenan), in Penang, in Province Wellesley (Butterworth), in Perak (Larut Hills, 3300 feet elevation), in Singapore, in Bangkok, in Ayuthia, and in the Dong Phya Fai (at Hinlap, 700 feet elevation).

Habits. Food consists of insects, especially crickets and cockroaches.

Description. (Drawn up from thirteen specimens from five different localities.) Snout moderate, obtuse. Lower eyelid scaly. Nostril behind the vertical of the suture between the rostral and the first labial; a postnasal; anterior loreal not deeper than the second, usually in contact with the first labial, in one specimen but slightly so, and in one specimen not in contact with it; supranasals not in contact behind the rostral in eight specimens, in contact in two specimens (in three this point was not noted); frontonasal broader than long, frequently much broader; præfrontals in contact mesially; frontal slightly shorter than the frontoparietals and interparietal together (in one specimen it is as long); frontal in contact with the second supraocular (in one specimen in contact with the first and second supraoculars); four supraoculars, second largest; normally six supraciliaries, first largest, but not unfrequently the fourth and fifth supraciliaries are fused into one shield, which is then the largest, or else the second and third may be welded together; frontoparietals distinct, in two specimens shorter, but usually larger, than the interparietal, which entirely separates the parietals; a pair of nuchals; four labials anterior to the subocular (except in a specimen from Ayuthia, which has on each side only three); subocular large and not narrowed inferiorly. Ear-opening roundish oval, about as large as a lateral scale, with a few (three, four, or five) small white lobules anteriorly (except in a specimen from

Bangkok, in which they were entirely absent[1]). 30 to 32 scales round the middle of the body, usually 32 (31 in two individuals and 30 in three), subequal; dorsals mostly distinctly tricarinate (in one specimen there are also from one to two subsidiary keels); nuchals less strongly keeled; laterals very feebly keeled; ventrals smooth. The hind limb reaches the elbow of the adpressed fore-limb. Subdigital lamellæ smooth. Scales on upper surface of arms smooth or very feebly keeled, on upper surface of legs feebly keeled.

Colour (in life). These lizards vary so much in colour and markings that they might be separated into an infinite number of varieties; but it seems to me (at any rate so far as Siamese and Peninsular specimens are concerned) that such divisions would be very artificial. There are certain broad distinctions which can be easily pointed out in selected individuals; but, with a large series before me, I find attempts to define varieties break down, also individual lizards vary at different seasons and under different conditions. An account of the colours of specimens from Borneo by Mr. Edward Bartlett will be found in the Journal, Straits Branch, Royal Asiatic Society, Aug. 1895, pp. 87, 90 & 91.

Bangkok and Ayuthia specimens are usually distinguished by a broad dark line along each side, separated from the brown back by a narrow pale line; thus they almost exactly resemble *M. siamensis* in colour; but specimens without the dark lateral line and with red sides instead (as is usual with Peninsular specimens) also occur.

Coloration of numerous specimens from the 8 localities mentioned on p. 645.—Above rich olive-green, yellowish olive, pale olive-brown, olive-brown, bronze-brown, or bronze; the back either uniform and immaculate ("Var. E, Duméril and Bibron" *apud* Cantor), or with small black spots which sometimes form five longitudinal black lines ("Var. D, D. & B." *apud* Cantor).

I. On each side, starting from the snout, passing through the eye and continuing on to the tail, a broad rich-dark-brown line.

II. Or on each side, starting from above and behind the ear and continuing either halfway down the body or to the inset of the hind leg, a broad red line, highly iridescent, changing to gold, orange, crimson, and green, as the light plays on the living animal ("Var. F, D. & B." *apud* Cantor, but I have never seen the "square *sky-blue* spots" he mentions). This line is broadest and brightest behind the shoulder.

III. Or the sides may be olive (like the back) with iridescent bronze-red lights, and a line of small black spots where the yellowish upper surface meets the red of the sides.

A well-defined pale buff or yellow (sometimes iridescent) dorso-lateral line, nearly two scales wide, is frequently present (invariably so in Bangkok and Ayuthia specimens that I have examined), which may be margined anteriorly and inferiorly with black spots.

[1] This specimen had some of the dorsal and hind-limb scales bicarinate; possibly it may be a hybrid between *M. multifasciata* and *M. siamensis*.

In some specimens this line starts from behind the nostril, passes above the eye and continues along the neck, sides of the back, and anterior third of the tail, where it gradually disappears.

The sides of the body and tail may be ornamented with a varying number (in some specimens none) of distinct or irregular yellow or white ocelli, each of which may be broadly edged above and below with black.

The sides of the head may be olive-brown or reddish olive (when not dark brown, as under I.), and the sutures between some or all of the shields on the top and sides of the head may be distinctly outlined in black ("Var. D, D. & B." *apud* Cantor.).

Limbs above olive-green or brown, with or without longitudinal black lines.

Tail above coloured like back, with or without black spots.

Lower surfaces: chin and throat bluish white, whitish, or yellowish like the body; body bright sulphur or pale greenish yellow; limbs sulphur or pale greenish yellow; tail yellowish anteriorly, olive-brown posteriorly.

Iris reddish orange, marked with dark bronze, yellowish bronze, or "black with a golden circular ring" (Cantor).

Inside of mouth purplish grey. Tongue purplish, sometimes nearly black.

Size. *Mabuia multifasciata* grows to a larger size than the other Skinks inhabiting this region; a male from Bangkok measures:—Total length 275 mm. (snt. to vnt. 120, tail 155); arm 31 mm.; leg 50 mm. This specimen has, however, a short tail; in proportion to those of smaller specimens the tail might have been 276 mm., which would give a total length of almost 400 mm.

Hab. Eastern Himalayas (?), Burma, Siam, Malay Peninsula, Nias, Java, Borneo, Celebes, Ternate, Gilolo, N. Ceram, Timor Laut, Lombok, Ombaai, Philippines.

77. MABUIA SIAMENSIS (Günther).

Mabuia siamensis, Blgr. Cat. Liz. iii. p. 188.

Siamese. "Ching-lane."

The type specimen was collected by M. Mouhot in Siam. I found this species very numerous in Bangkok; it is found in the same localities as *Mabuia multifasciata*, which it resembles in habits and general appearance, and to which it is *very closely* allied.

Description. (Drawn up from eighteen Bangkok specimens.) Snout moderate, obtuse. Lower eyelid scaly. Nostril behind the vertical of the suture between the rostral and the first labial; a postnasal; anterior loreal not in contact with the first labial in eight specimens, slightly in contact in eight specimens, and slightly in contact with it on one side of the head, but not in contact on the other side, in one specimen; supranasals not in contact behind the rostral in four specimens, in contact in fourteen specimens; frontonasal about as broad as long, or broader than long; præfrontals in contact mesially in six specimens, not in contact in eleven specimens; frontal shorter than the frontoparietals

and interparietal together; frontal in contact with the second supraocular (in one specimen in contact with the second and third supraoculars); four supraoculars, second largest; normally six supraciliaries, first largest (in one specimen there were six supraciliaries on one side and seven on the other, another specimen had only five); frontoparietals distinct, as long as or slightly shorter than the interparietal, which entirely separates the parietals, except in one specimen, where they just touch each other behind the interparietal; a pair of nuchals; four labials anterior to the subocular, which is large and not narrowed inferiorly. Ear-opening oval and oblique or nearly round, as large as or a little larger than a lateral scale; no projecting lobules. 28 scales round the middle of the body in fourteen specimens, 30 in four specimens; dorsals very slightly larger than the remainder; dorsals distinctly bicarinate in seven specimens, feebly so in one specimen, distinctly tricarinate in two specimens, and in the remainder some are bi- and some tricarinate, the keels being either distinct or indistinct; ventrals very feebly bicarinate or smooth. The hind-limb reaches the elbow of the adpressed fore-limb. Subdigital lamellæ smooth, 24 to 26 under the fourth toe.

Colour (in life). Above bronze-brown, the back generally uniform and immaculate, but sometimes with five more or less distinct narrow longitudinal black lines; along each side from behind the eye to the basal part of the tail a broad black or dark brown line, 2½ to 3 scales wide (in two specimens this dark line was sparsely dotted with light bronze), separated from the bronze back by a narrow, sharply defined, pale yellow line, one scale wide. Labials, sides of neck and body pale sulphur or greenish yellow, usually sharply defined from the dark lateral line above, but in a few specimens spotted with dark brown. Lower surfaces pale or bright emerald, or yellowish green.

Size. Total length 330 mm. (snt. to vnt. 116 mm.; tail 214 mm.); arm 37 mm.; leg 52 mm.; width of head 16·5 mm.

Hab. Siam, Hainan.

78. MABUIA LONGICAUDATA (Hallow.).

Mabuia longicaudata, Blgr. Cat. Liz. iii. p. 189.

Hab. Siam.

79. LYGOSOMA ANOMALOPUS Blgr.

Lygosoma anomalopus, Blgr. P. Z. S. 1890, p. 84, pl. xi. fig. 4.

Hab. Malay Peninsula (Penang), Sumatra.

80. LYGOSOMA MACULATUM (Blyth).

Lygosoma maculatum, Blgr. Cat. Liz. iii. p. 242.

Localities. Of this skink, which does not seem to have been previously recorded from either the Malay Peninsula or Siam, I have seen twelve specimens. One I got in the Larut Hills, Perak, elevation 1000 feet; one I caught in the jungle of the Dong Phya

Fai (near Muok Lek, elevation 900 feet); one was given me as having been caught in Bangkok; and there were nine in the store of the Siamese Museum, supposed to have been collected by the late Dr. E. Haase at Chantaboon.

Description. On comparing these latter specimens with the description of this species in the British Museum Catalogue, these points were noted:—1st, in some individuals the fifth and sixth labials appear welded into one large shield beneath the eye. 2nd, the number of scales round the body appears large, 40 to 50. 3rd, the hind limb when adpressed is longer, reaching from just in front of the axilla to the shoulder; in the Bangkok specimen it also reaches the shoulder.

Colour (in spirit). Brown or olive-brown above, with more or less distinct darker and lighter spots, sometimes forming two irregular dorsal series of small black spots; a very dark brown lateral line, extending from the nostrils, through the eye, above the ear, and on to the tip of the (unreproduced) tail; this dark line is more or less spotted with white, and edged below (sometimes also above narrowly) with white, and on the tail it is vandyked; flanks dark brown, spotted with white; lower surfaces pale yellow or white.

Size. Total length 171 mm. (snt. to vnt. 65; tail 106).

Hab. Eastern Himalayas (Sikhim), Northern Bengal, Assam, Burma, Andaman Islands, Siam, Malay Peninsula.

81. LYGOSOMA OLIVACEUM (Gray).

Lygosoma olivaceum, Blgr. Cat. Liz. iii. p. 251; S. Flower, P. Z. S. 1896, p. 874.

Recorded from Singapore, Penang, and the Peninsula.

Hab. Tenasserim, Nicobars, Malay Peninsula, Sumatra, Java Borneo, Philippines.

82. LYGOSOMA ATROCOSTATUM (Lesson).

Mabouya jerdoniana, Stol. J. A. S. B. 1870, p. 172.
Lygosoma jerdonianum, Blgr. Cat. Liz. iii. p. 300.
Lygosoma atrocostatum, Blgr. op. cit. p. 295.

The type of Jerdon's Skink was caught by Stoliczka on the little rocky island of Pulo Tikus Kechil, which lies off the north-east coast of Penang. I twice visited the island to try to obtain another specimen. On the first occasion, in Nov. 1896, not a skink was seen, but on the second, in April 1898, after our whole party had hunted unsuccessfully all through the middle of the day, at about 4·30 p.m., as we were returning to our boat, I saw a skink on a granite boulder on the beach, which I shot, and found it agreed completely with Stoliczka's description. The only other reptiles we obtained on the island were the common House Geckoes, *Gehyra mutilata* and *Hemidactylus frenatus*.

Colour (in life). Above, olive-green and bronze, beautifully mingled. Below, throat pale lilac-grey, body and limbs orange, tail greenish yellow.

Size. Total length 183 mm. (snt. to vnt. 70; tail 113); arm 25 mm.; leg 38 mm.; width of head 12 mm.

Hab. Malay Peninsula, Celebes, Philippines, Moluccas, Papuasia, Cape York, Caroline and Santa Cruz Islands.

83. LYGOSOMA SINGAPORENSE (Steindachn.).

Lygosoma singaporense, Blgr. Cat. Liz. iii. p. 297.

Hab. Malay Peninsula (Singapore).

84. LYGOSOMA MELANOSTICTUM Blgr.

Lygosoma melanostictum, Blgr. Ann. Mus. Genova (2) v. 1887, p. 479, pl. vii. fig. 2.

Localities. Of this skink, which does not seem to have been previously recorded from Siam, I have seen five specimens, four said to have been caught in Bangkok and one from Chantaboon.

Description. The latter specimen only differs from the description of this species in the British Museum Catalogue in the following points:—1st, frontal shorter than frontoparietals and interparietal together; 2nd, about 38 smooth scales round the middle of the body; 3rd, præanals distinctly enlarged; 4th, the adpressed limbs overlap.

Colour (in spirit). Above pale bronze-brown, with indistinct darker brown spots forming two irregular dorsal lines; an indistinct darker brown lateral line from behind the eye to the base of the tail, narrowly and indistinctly bordered above with yellow; lower surfaces and lips pale yellowish green.

Hab. Burma, Siam.

85. LYGOSOMA BOWRINGII (Günther).

Lygosoma bowringii, Blgr. Cat. Liz. iii. p. 308, pl. xxiii. fig. 3.

Siamese. "Mee-ang-ngu" (a term which more properly applies to *L. chalcides*).

Localities. It seems curious that Bowring's Skink does not appear to have been hitherto recorded from Siam, where I found it at Bangkok, Ayuthia, Kosichang, and Chantaboon. Peters recorded a specimen from Singapore, but I know of no other instance of its being found there or in other parts of the Straits Settlements.

Habits. Though very numerous in Siam this lizard is seldom seen by the ordinary observer, as, instead of delighting in brilliant sunshine like *Mabuia siamensis*, it spends the day hiding under stones, logs, &c., and only goes abroad after its prey at twilight.

Description. (Drawn up from fifteen Siamese specimens.) Body elongate, limbs short. The distance between the end of the snout and the fore-limb is to the distance between axilla and groin as 1 is to from $1\frac{10}{14}$ to $2\frac{3}{14}$. Snout short, obtuse. Lower eyelid scaly. Supranasals in contact behind the rostral; frontonasal much broader than long, forming a broad suture with the frontal; præfrontals small; frontal as long as frontoparietals and interparietal together, in contact with the first and second supraoculars; four

supraoculars; seven supraciliaries, first and last largest; fronto-parietals distinct; interparietal distinct, smaller than fronto-parietals; parietals forming a suture behind the interparietal; a pair of nuchals and a pair of temporals border the parietals; usually fifth upper labial largest and bordering the orbit; in one specimen in which both fourth and fifth border the orbit, the fourth is the largest upper labial. Ear-opening round, moderate-sized or small. 28 scales round the middle of the body (in one specimen 30), subequal; dorsals *smooth*. Marginal præanals slightly enlarged. The adpressed limbs fail to meet; the hind-limb is in length to the distance between axilla and groin as 1 is to from $1\frac{13}{14}$ to $2\frac{8}{14}$. Tail thick.

Colour (in life). (Drawn up from fifteen Siamese specimens.) Upper surface of head, body, tail, and limbs olive-brown, each dorsal scale with a darker spot forming six more or less continuous parallel narrow black lines, which are most distinct anteriorly and grow fainter posteriorly (in some individuals only the centre and outer pair of lines are distinguishable). Along each side there is a very dark brown or black line, which starts from the nostril, passes through the lower part of and below the eye, and is continued to the tail, where it gradually disappears. This dark lateral line is separated from the olive-brown back by a narrow pale yellow dorso-lateral line, which commences from behind and above the eye, runs all along the neck and body and is continued, less distinctly, on to the tail. The limbs, sides of the head, body and tail vary from pale pink to bright vermilion, and are spotted with black and yellow; these spots are largest on the body and very small on the limbs. Lower surfaces: chin, throat, and lower labials vary from bright sulphur-yellow to pale coral-red; body varies from bright sulphur to greenish yellow or greyish buff; tail varies from yellow to pale coral-red.

The whole surface of the lizard is very metallic.

Size. The largest specimen, of nineteen I have measured, was 55 mm. from snout to vent, the arm 9 mm., and the leg 13 mm., but the tail only 40 mm., being a reproduced one, but if perfect (according to an average arrived at from nine individuals with perfect tails) it would have been 67 mm. long, giving a total length of 122 mm.

Hab. Burma, Hongkong, Siam, Malay Peninsula, Borneo (where I caught a specimen on Pulo Gaya), Celebes.

86. LYGOSOMA ALBOPUNCTATUM (Gray).

Lygosoma albopunctatum, Blgr. Cat. Liz. iii. p. 309

Hab. India, Assam, Burma, Malay Peninsula.

N.B.—LYGOSOMA ISODACTYLUM (Günther).

Lygosoma isodactylum, Blgr. Cat. Liz. iii. p. 339.

The type-specimen was obtained by M. Mouhot in Cambodia, so the species may eventually be found in Siam.

Hab. Cambodia.

87. Lygosoma chalcides (Linn.).

Lygosoma chalcides, Blgr. Cat. Liz. iii. p. 340.

Siamese. "Mee-ang-ngu."

This curious little skink is recorded from Penang Hill and Singapore by Cantor (p. 49), and from Bangkok by Boettger (Zool. Anz. 1893, no. 433, p. 430). I got one specimen on Penang Hill, elevation about 2200 feet; one I found under a stone paving-flag in a garden in Bangkok, and one was caught on board the s.s. 'Hecate' on a voyage from Siam to Singapore; I also obtained seven specimens from Chantaboon and three said to be from Kosichang.

Colour (in life). Above pale buff, with numerous fine longitudinal, beautiful golden-brown lines. Below white, with numerous fine longitudinal zigzag brown lines. Top of head dark brown. Lips pale buff.

Size. The largest Siamese specimen measured in total length 155 mm. (snt. to vnt. 70; tail 85).

Hab. Southern China, Siam, Malay Peninsula, Java.

Note A.—Of two snakes (*Lycodon subcinctus*) which I got in the Larut Hills, Perak, at an elevation of 4400 feet, each had a lizard in its stomach, belonging to some species of *Lygosoma*; unfortunately they were in too advanced a state of digestion to be determined, but apparently they indicate a species to be subsequently added to the list of Malay Peninsula reptiles.

Colour (when found). Above rich olive-brown, with black oblong spots; sides olive, spotted with black and white; lower surfaces bright yellowish green.

Size. Total length 188 mm. (snt. to vnt. 93; tail 95).

Note B.—Tropidophorus cochinchinensis (Dum. & Bibr.).

Tropidophorus cochinchinensis, Blgr. Cat. Liz. iii. p. 363.

The type-specimen of *T. microlepis* was obtained by M. Mouhot in Cambodia, so the species may be eventually found in Siam.

Hab. Cambodia, Cochinchina.

Suborder OPHIDIA.

Native names :—
Siamese. "Ngu."
Malay. "Ular."
Jakun. "Kichon."
Jakun Camphor language. "Akar." } Lake & Kelsall, J. S. B. R. A. S. no. 26, 1894, pp. 48 & 55.

Family Typhlopidæ.

88. Typhlops lineatus Boie.

Pilidion lineatum, Cantor, p. 50.
Typhlina lineata, Günth. Rept. Brit. Ind. p. 171, pl. xvi. fig. B.
Typhlops lineatus, Blgr. Cat. Snakes, i. p. 15.

Two specimens of this Blind Snake have been obtained on

Penang Hills (Cantor & S. Flower, P. Z. S. 1896, p. 876), and the British Museum Catalogue records it from Malacca and Singapore.

Hab. Malay Peninsula, Java, and probably Sumatra.

89. TYPHLOPS BRAMINUS (Daud.).

Typhlops braminus, Blgr. Cat. Snakes, i. p. 16; S. Flower, P. Z. S. 1896, p. 876.

Siamese. "Ngu-din"=earth snake.

Malay. "Ular tana"=earth snake.

The common Burrowing Snake has been recorded from Penang, Singapore, the Malay Peninsula, and Bangkok. It is believed by the Siamese to be very poisonous, and even when I have handled a live one to show how absolutely harmless and quiet it is, the natives would not be persuaded, believing (as they usually do in such cases) that I have a special charm or power over the snake and that the bite would be fatal to themselves.

I have specimens from Penang, Taiping (Perak), Bangkok, and Chantaboon; the longest being 170 mm. in length.

Hab. Arabia, Ceylon, India, Nepaul, Burma, Siam, Hongkong, Formosa, Malay Peninsula, Java, Borneo, Celebes, Philippines, Madagascar, Mauritius, Comoro Islands, Cape of Good Hope.

90. TYPHLOPS BOTHRIORHYNCHUS Günth.

Typhlops bothriorhynchus, Blgr. Cat. Snakes, i. p. 23.

The type is supposed to be from Penang; at present we have no other evidence of the occurrence of this species in Malaya.

Hab. Northern India (North-west Provinces and Assam), Malay Peninsula.

91. TYPHLOPS SIAMENSIS Günth.

Typhlops siamensis, Blgr. Cat. Snakes, i. p. 24.

The type-specimen was collected in Siam by M. Mouhot.

Hab. Siam.

92. TYPHLOPS NIGROALBUS D. & B.

Typhlops nigroalbus, Blgr. Cat. Snakes, i. p. 24; S. Flower, P. Z. S. 1896, p. 876.

The Black-and-white Blind Snake is recorded from Penang, Perak, and Singapore. The finest individual I have observed measured 400 mm. in length and 47 mm. in girth; it was obtained in Penang, at 2500 feet elevation, by Mr. A. G. B. van Sommeren.

Hab. Malay Peninsula, Sumatra.

93. TYPHLOPS SCHNEIDERI Jan.

Typhlops schneideri, Blgr. Cat. Snakes, i. p. 27.

Recorded from Bangkok.

Hab. Siam.

94. TYPHLOPS ALBICEPS. (Plate XXXVII. fig. 1.)

Typhlops albiceps, Blgr. Ann. & Mag. N. H. ser. 7, vol. i., Feb. 1898, p. 124.

This species was described from a single specimen I obtained from a native, who said it was from Chantaboon; afterwards we found a second individual among some earth in our garden at Bangkok.

Colour (in life). Above and below uniform dark brown, highly iridescent. Head very pale purplish pink, turning to pale yellow on the snout. The tip and under surface of the tail are whitish buff. Total length 190 mm.

Hab. Siam.

95. TYPHLOPS FLOWERI[1]. (Plate XXXVII. fig. 2.)

Hab. Siam.

Family BOIDÆ.

96. PYTHON RETICULATUS (Schneid.).

Python reticulatus, Cantor, p. 55; Blgr. Cat. Snakes, i. p. 85.

Siamese. "Ngu-laam."

Malay. "Ular sawa."

Localities. The Reticulated Python (commonly called "Boa Constrictor" by the English of Indo-China) is fairly numerous in suitable places in the Malay Peninsula. I have seen specimens from Penang, Province Wellesley, Perak, Selangor, Johore, and Singapore. In Siam I have seen only Bangkok specimens, but there can be no doubt that this snake is widely distributed through the country.

Habits. This python is very numerous in the city and suburbs of Bangkok; in almost every compound of which I know the occupants, either private houses or offices, one or more pythons have been found within the last few years. Strange to say, it is not in the quiet jungle-forest that the python seems to prefer to live, but in the busiest spots along the Menam, where steamers and junks are loading and unloading, steam-launches whistling, steam-saws buzzing, rice-mill chimneys filling the air with smoke, and hundreds of noisy coolies passing to and fro; here he selects some hole or crevice in building, timber-stack, or bank to spend the day in, and at night makes an easy living, devouring fowls, ducks, cats, dogs, and, it is said, pigs (which, together with countless

[1] *Typhlops floweri*, sp. n.—Snout rounded, very prominent; nostrils lateral. Rostral two-fifths the width of the head; nostril between two nasals, the anterior in contact with the first and second labials; a præocular, narrower than the ocular, in contact with the second and third labials; eyes distinguishable; upper head-scales scarcely enlarged; four upper labials. Diameter of body 85 times in the total length; tail three times as long as broad, rounded at the end, without spine; 18 scales round the body. Black; snout and anal region yellowish. Total length 210 millim.

A single specimen from Siam, without precise locality, was sent to the British Museum by Mr. Flower, after whom I have the pleasure of naming the new species.—G. A. BOULENGER.

pariah-dogs, vultures, kites, and crows, are the regular scavengers of Bangkok).

In May 1897, a python, 2820 mm. (or 9 ft. 3 in.) in length, was found in the Wang Luang (King's Palace); I was told it had swallowed a pet cat and then had become too fat to get away through the hole by which it had entered. On opening the snake, I found a full-grown Siamese cat with a bell hung round its neck. In January 1898 another, 2438 mm. (or 8 ft.) in length, was caught alive in the Wang Na (2nd King's Palace). The activity, muscular strength, and more particularly the power with which it can strike out with its head, of a python even of this comparatively very small size is astonishing, and, together with the lovely sheen of colours which flashes over the bold patterns on its scales, is difficult to realize when you have seen these snakes only in captivity in Europe.

Size. A friend told me that when the wooden floor of his stables in Bangkok was being repaired during 1897, in a cavity underneath a large python was found and killed, which measured over 6·09 metres (or 20 feet) in total length. One killed at Matang, Perak, the skin of which measures about 6 metres, is in the possession of Lt.-Col. Froude Walker, C.M.G., who told me the python had been known to kill and eat pigs. Another killed at Simpang (Larut district), Perak, measuring 6·7 metres (or 22 feet), is now in the Taiping Museum. Dr. Wilson, Senior Medical Officer in Johore, told me of a python killed at Muar about 1889, which was 6·85 metres (or 22½ feet) long and 228 mm. (or 9 inches) in diameter. And Mr. L. Wray, jun., has measured one killed near Taiping, Perak, about 1896, which was in the flesh 8·2 metres (or 27 feet) long, and when skinned and stretched 10 metres (or 33 feet). Cantor writes : "In 1844 one was killed at the foot of Pinang, which a gentleman informed me measured more than 30 feet."

Hab. Burma, Siam, Malay Peninsula, Sumatra, Java, Banka, Sipora (Mentawei Is.), Great Natuna Is., Borneo, Celebes, Flores, Amboina, Ternate, N. Ceram, Timor Laut, and Philippines.

97. PYTHON MOLURUS (L.).

Python molurus, Blgr. Cat. Snakes, i. p. 87.

The common Python of India is included in the list of Malay Peninsula reptiles, so far as I am aware, solely on the authority of Stoliczka (J. A. S. B. 1870, p. 205), who mentions having "seen several specimens obtained in the Wellesley province." I have not heard of its occurrence in Siam.

In recording localities of animals, such as this python, which form part of the usual stock-in-trade of itinerant native jugglers, it behoves collectors to be very careful and to make all possible enquiries regarding them : for instance, when in Bangkok I once was brought a live *Python molurus*, but found by questioning that it had been brought there by an Indian conjurer from Bombay.

Hab. India, Ceylon, South China, Malay Peninsula, Java, Celebes.

98. PYTHON CURTUS Schleg.

Python curtus, Blgr. Cat. Snakes, i. p. 89, and P. Z. S. 1889, pl. xlv.

Recorded from Malacca and Singapore.

Hab. Malay Peninsula, Sumatra, Borneo.

Family ILYSIIDÆ.

99. CYLINDROPHIS RUFUS (Laur.). (Plate XXXVII. fig. 3.)

Cylindrophis rufus, Cantor, p. 53; Blgr. Cat. Snakes, i. p. 135.

Siamese. "Ngu-kan-rob," *also* "ngu-kan-kop."

Malay. "Ular dua kapala" = two-headed snake.

This curious burrowing snake is not uncommon. I have seen specimens from Taiping in Perak, Kuala Lumpor in Selangor, Johore Bahru, Singapore, and ten individuals from Bangkok. It is also recorded from Penang. The Bangkok specimens had each 21 rows of scales.

Habits. At ordinary times this snake is fairly cylindrical in section, and uses its tail in progression, putting the sharp tip against the ground and pushing its body forward from it; but it has the power of depressing its body, when its appearance is very singular: the neck and anterior part of the body are but slightly compressed, but posteriorly it is very much so. Consequently, when *seen from above* the outline of the snake is much that of a Sea-snake seen from the side. When touched or worried it will not attempt to strike or bite, but keeps its head flat on the ground, usually hidden under the folds of the body; its *tail*, however, it raises off the ground and holds aloft curved over backwards in the most extraordinary manner, so that any casual observer would imagine the tail was the head and think the snake to be threatening to strike. Sometimes the tail is not curved over, but held in the manner most snakes hold their heads when advancing. In captivity *Cylindrophis rufus* avoids the light and creeps into any dark corner.

Colour (in life). The following description of a Bangkok specimen with *no* "orange collar-mark" may be compared with that of a Singapore specimen (P. Z. S. 1896, p. 877):—Above intense iridescent black, with three brown cross-bands interrupted in the vertebral line. Below black, with about forty-nine transverse pale yellow bands (turning china-white after death). Only those bands about the middle of the body are regularly formed; most of those on the anterior and posterior parts do not meet along the middle line. A bright vermilion mark on the tail. Inside of mouth bright red.

Size. The largest Bangkok specimen was 732 mm. in total length, but one from Kuala Lumpor measured 825 mm.

Hab. Burma, Siam, Cambodia, Malay Peninsula, Sumatra, Java, Borneo, Celebes.

100. CYLINDROPHIS LINEATUS Blanf.

Cylindrophis lineatus, Blgr. Cat. Snakes, i. p. 137.

This snake is only known from the type specimen in the Raffles Museum, Singapore, described by Mr. Blanford (P. Z. S. 1881, p. 217, pl. xx.).

Hab. Malay Peninsula.

Family XENOPELTIDÆ.

101. XENOPELTIS UNICOLOR Reinw.

Xenopeltis unicolor, Blgr. Cat. Snakes, i. p. 168 (skull figured); S. Flower, P. Z. S. 1896, p. 878.

"Ngu saam-paa-teek" of the Siamese.

Localities. This remarkable snake is known from Penang Hill (Cantor, p. 54); Province Wellesley (Cantor, p. 54, and Mr. van Sommeren's collection); Kuala Selangor (Mr. A. L. Butler's collection); Pahang (Dr. Hanitsch, Rep. Raffles Libr. & Museum, 1897, p. 9); Singapore (Brit. Mus. Cat.; Peters, Monatsb. Ak. der Wiss. zu Berlin, 1859, p. 269; Rep. Raffles Libr. & Museum 1897; and my own collection).

The British Museum Catalogue mentions two specimens from Siam; and I have observed ten Bangkok individuals and one from Chantaboon.

Habits. A young snake of this species that I kept alive was fairly quiet from the first, and after one day's captivity never attempted to bite when handled. An adult specimen when excited would twist itself into an irregular pile of tight coils, except the tail, which was held on one side, raised from the ground, and the tip kept vibrating at a great speed.

Description. In six Siamese specimens the number of ventral shields was 180, 184, 185, 186, 188, and 196, and of subcaudals was respectively 27 (2nd), 29 (2nd), 29 (1st), 28 (1st), 28 (2nd), and 27 (1st), which were double, except those whose number, counting from the anterior end of the tail, is shown in brackets, which were single. The anal is always divided, and the scales in 15 rows.

Colour (in life). The iridescent colours of this snake are most beautiful and wonderful. As it crawls along, the curves of its body flash brilliant lights of emerald-green, copper, blood-red, purple and electric-blue, while the actual colour is a very dark rich coffee-brown. The upper labials and whole lower surfaces are uniform pale yellow. Individuals up to 250 mm. in length have a distinct broad yellow collar, which disappears entirely in adults.

Size. The largest Bangkok specimen I have measured was 775 mm. in total length, but the species grows larger than that.

Hab. Southern India, Burma, Siam, Malay Peninsula, Sumatra, Nias, Java, Borneo, Celebes.

Family Colubridæ.

Series Aglypha.

Subfamily Acrochordinæ.

102. Acrochordus javanicus Hornstedt.

Acrochordus javanicus, Cantor, p. 58; Blgr. Cat. Snakes, i. p. 173.

Siamese. "Ngu charng-naam" = "water-elephant snake."

Malay. "Ular karong" = sack snake
„ "Ular sapi" = ox snake
„ "Ular lemba" = cattle snake
} (*apud* Cantor).

Cantor mentions this species from Penang Hill and Singapore. In June 1898, Mr. A. L. Butler showed me a live specimen that had been caught in a fish-trap in fresh water near Kuala Lumpor, Selangor; it was 1778 mm. in length and had about 152 rows of scales (counted by Mr. Butler). The Raffles Museum contains a specimen from Pahang (R. Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 9). It does not seem to have been previously recorded from Siam, but it is found in the neighbourhood of Bangkok, and is valued for its skin, which is used for making the drum-heads of native drums. The largest specimen I obtained was from Sapatoom, and measured 1830 mm. (6 feet) in total length.

This snake, when alive and fresh caught, is of immense girth and very powerful, twisting round one's arms with a grasp like that of a python. It seems to be purely aquatic (though Cantor records an exception), frequenting canals and ditches. On land as a rule it is very sluggish, but when aroused will strike suddenly with great force, and can inflict an unpleasant bite, as its teeth are apt to break off in the wound.

I tried keeping two in a tank with some freshwater tortoises, *Cyclemys platynota*. The snakes did them no harm, but the tortoises (although they had lived peacefully with other aquatic snakes, *Homalopsis buccata* and species of *Tropidonotus*), for some unknown reason, attacked the Acrochordi and repeatedly bit them about the head, so that they had to be separated.

Hab. Siam, Malay Peninsula, Java, New Guinea.

103. Chersydrus granulatus (Schneid.).

Acrochordus granulatus, Cantor, p. 59.

Chersydrus granulatus, Blgr. Cat. Snakes, i. p. 174.

Malay. "Ular limpa" = liver-coloured snake (*apud* Cantor).

Cantor also gives "Ular laut" as a Malay name for this species, but every snake which is found in the sea is called "ular laut," *i. e.* sea-snake.

Recorded from Penang (Cantor) and from Singapore (Brit. Mus. Cat.). Mr. Ridley informs me this autumn (1898) a "*Chersydrus granulatus* was picked up in the road by the Botanical Gardens,

Singapore), dirty brown and white in rings, a very sluggish beast."

In the Kuala Lumpor Museum there is a small specimen, caught (in the act of swallowing a fish) at sea in the Straits of Malacca between Klang and Singapore.

In the Siamese Museum there is a large stuffed specimen said to be from Bangkok.

Hab. Ceylon, Madras, Burma, Siam, Cochinchina, Malay Peninsula, Sumatra, Java, Borneo, Celebes, Philippines, New Guinea.

104. XENODERMUS JAVANICUS Reinh.

Xenodermus javanicus, Blgr. Cat. Snakes, i. p. 175.

Recorded from Penang (F. Müller, Verh. nat. Ges. Basel, 1887, p. 268).

Hab. Malay Peninsula, Sumatra, Java.

Subfamily COLUBRINÆ.

105. POLYODONTOPHIS GEMINATUS (Boie).

Herpetodryas prionotus, Cantor, P. Z. S. 1839, p. 52.
Polyodontophis geminatus, Blgr. Cat. Snakes, i. p. 185.

Recorded from Malacca and Singapore (P. Z. S. 1896, p. 879).

Hab. Siam (Blgr. Cat. Snakes, i. p. 185), Malay Peninsula, Sumatra, Java, Borneo, Lombok.

106. POLYODONTOPHIS SAGITTARIUS (Cant.).

Calamaria sagittaria, Cantor, p. 64.
Polyodontophis sagittarius, Blgr. Cat. Snakes, i. p. 187.

Cantor mentions one specimen from the Malay Peninsula.

Hab. West Himalayas, Bengal, Assam, Malay Peninsula.

107. XENOCHROPHIS CERASOGASTER (Cant.).

Tropidonotus cerasogaster, Cantor, p. 92.
Xenochrophis cerasogaster, Blgr. Cat. Snakes, i. p. 191.

Cantor mentions one specimen from the Province Wellesley.

Hab. Bengal, Assam, Khasi Hills, Malay Peninsula.

108. PRYMNOMIODON CHALCEUS Cope.

Hab. Siam (Blgr. Cat. Snakes, i. p. 192).

109. TROPIDONOTUS TRIANGULIGERUS Boie.

Tropidonotus trianguligerus, Blgr. Cat. Snakes, i. p. 224.

Recorded from Penang and Singapore (*vide* P. Z. S. 1896, p. 879).

I have seen a specimen from Penang Hill, 2400 ft., and obtained another near the foot of Gunong Pulai, Johore, 790 mm. in length.

Colour (in life). Above dark olive, with small black spots forming indistinct cross-bands or reticulations; on the anterior half of the body a lateral series of large triangular black spots, with the points extending down to the ventrals, separated by interspaces of bright coral-red; belly yellow, some of the ventrals partially edged with black: subcaudals yellow, each scale edged with black; upper labials yellow with black sutures.

Hab. Southern Burma, Malay Peninsula, Sumatra, Nias, Sipora, (Mentawei Islands), Java, Borneo, Celebes, Ternate.

110. TROPIDONOTUS PISCATOR (Schneid.)

Tropidonotus piscator, Blgr. Cat. Snakes, i. p. 230.

Siamese. "Ngu lai-sau"; "lai" means *variegated.*

Localities. Var. A. The specimen from Singapore mentioned in the Brit. Mus. Cat. is the only instance I know, of this variety, in this region.

Var. B. To this variety of the Indian Fishing Snake belong Cantor's Penang specimen, and those obtained by Mouhot in Siam and Cambodia; and I have seen six specimens caught in Penang at various elevations from sea-level to 2200 feet. In May and June 1898, these snakes were *very* numerous near Alor Star, Kedah, and it is one of the commonest in Bangkok.

Habits. The Fishing Snake seems generally to be found in or near fresh water. When newly caught and frightened it is apt to be fierce, but soon becomes tame in captivity. Its food includes frogs; I have known it to eat *Microhyla ornata.*

Colour (in life).—Var. B. Above olive-brown, black-spotted. Below whitish, ventrals and subcaudals more or less edged with black. A specimen, 360 mm. in length, caught in the Wang Na, Bangkok, 21st July 1898, was unusually coloured:—Above dark olive-brown, indistinctly spotted with black. Along each side a series of distinct black spots, the interspaces being pale olive-brown, broadly marked with *bright scarlet*, which gave the snake a striking appearance. Below pale greenish yellow, each ventral and subcaudal neatly outlined in black. Head above olive-brown, with two small well-defined black-edged yellow spots close together on the parietals (these two spots are frequently noticeable in Bangkok specimens); sides of head yellowish, two parallel black lines running obliquely backwards and downwards from the eye. Under surface of head dull whitish. Iris yellowish green, with narrow golden ring round pupil.

Size. A female from Penang Hill was 952 mm. in length.

Hab. India, Burma, South China, Siam, Cambodia, Malay Peninsula, Java, Borneo.

111. TROPIDONOTUS TIGRINUS Boie.

Hab. Manchuria, China, Japan, Cochinchina, Siam (Blgr. Cat. Snakes, i. p. 249).

Description.

No.	Locality.	Scales.	Ventrals.	Sub-caudals.	Post-oculars.	Upper Labials.	Temporals.
1.	Penang Plain...	...	125	77			
2.	,, Hill ...	19	127	78	3	9 (4th and 5th enter eye).	
3.	,, ,, ...	19	139	...	4	9 (4th enters eye).	2+3
4.	,, ,, ...	17	136	67			
5.	Kedah	19	126	82			
6.	,, ...	19	127				
7.	,, ...	19	134				
8.	,, ...	19	138	73			
9.	,, ...	19	138	74			
10.	,, ...	19	138 (L.D.).[1]	73			
11.	,, ...	19	139				
12.	,, ...	19	139 (L.D.).	75			
13.	Bangkok.....	19	124	...	4	9 { 4th does not quite enter eye. 5th is separated from 4th by lowest postocular.	
14.	,, ...	19	124	88	3		
15.	,, ...	19	125 (L.D.)	78	3	.....	2+3
16.	,, ...	19	129	86	3	9 (4th enters eye).	
17.	,, ...	19	130	89	4	9 (4th and 5th enter eye).	
18.	,, ...	19	137	66	3	9 (4th and 5th enter eye).	2+2
19.	,, ...	19	137 (L.D.)	75	3	.....	2+2 { with a 3rd median shield placed in second row, but not in contact with anterior row.
20.	,, ...	19	138	76	3	.....	2+3
21.	,, ...	19	138	85	3	.....	2+2

[1] L.D. signifies that the last ventral shield is divided.

112. TROPIDONOTUS STOLATUS (L.).

Tropidonotus stolatus, Cantor, p. 90; Blgr. Cat. Snakes, i. p. 253.

Recorded from Penang, Singapore and the Malay Peninsula.

Hab. Ceylon, India, Burma, China, Formosa, Hainan, Hongkong, Malay Peninsula, Philippines.

113. TROPIDONOTUS VITTATUS (L.).

Tropidonotus vittatus, Stol. J. A. S. B. 1873, pt. 2, p. 114; Blgr. Cat. Snakes, i. p. 255.

Hab. Malay Peninsula, Java, Celebes.

114. TROPIDONOTUS SUBMINIATUS, Schleg.

Tropidonotus subminiatus, Blgr. Cat. Snakes, i. p. 256.

Siamese. "Ngu lai-sarp."

Localities. I have not been able to find out on what authority this snake is recorded from the Malay Peninsula. M. Mouhot obtained specimens from Siam, Cambodia, and the Laos Mountains. I have seen seven Bangkok specimens, one being from the Rong Law on the west bank of the Menan, but most were caught in the compound of the Siamese Museum.

Habits. Specimens we kept in captivity were observed to eat frogs and small toads—*Rana limnocharis*, *Microhyla ornata*, and *Bufo melanostictus*.

Description.

No.	Locality.	Ventrals.	Subcaudals.	Temporals.	Upper Labials.
1.	Bangkok...	138	72	2+3	8 (3rd, 4th, 5th enter eye).
2.	„ ...	144	71	2+3	8 („ „).
3.	„ ...	145	73	2+3	8 on one side, 9 on the other.
4.	„ ...	147	...	2+3	
5.	„ ...	150	...	2+2	8 (3rd, 4th, 5th enter eye).
6.	„ ...	151	70	2+2	9 („ „).

Specimens 2 and 5 had five lower labials on each side in contact with the anterior chin-shields; specimens 1 and 6 had five lower labials on one side and six on the other in contact with the anterior chin-shields; in specimens 3 and 4 the anterior chin-shields were a little longer than the posterior.

Colour (in life). Above dark olive-brown (browner on the body, greener on the head and neck), more or less obscurely mottled with black. The skin between the scales is yellow or greenish golden and shows as bright reticulations, especially when the snake is distended with food. Young specimens have a jet-black cross-band on the nape, bordered posteriorly by a narrow bright

yellow collar; the neck behind this collar is brilliant vermilion and in adult specimens red or crimson. Below immaculate white or yellow, shading to pink where it joins the dark upper parts. Sides of the head and neck bright yellow; below each eye a black triangular patch extending backwards and downwards (in one individual this mark was only present on the right side).

Size. The largest Bangkok specimen measured 690 mm. in total length.

Hab. Eastern Himalayas, Assam, Burma, South China, Siam, Cambodia, Malay Peninsula, Java, Celebes, Ternate.

115. TROPIDONOTUS CHRYSARGUS Schleg.

Tropidonotus junceus, Cantor, p. 93.

Tropidonotus chrysargus, Blgr. Cat. Snakes, i. p. 258.

This beautiful snake appears to be a mountain form in the Malay Peninsula. Cantor got one individual on Penang Hill, and Mr. L. Wray, Dr. Hanitsch, and myself have in different years obtained it in the Larut Hills, Perak, from 3000 to 3400 feet above the sea.

Habits. Cantor says: "Like most of the Asiatic species of this genus, the present is of fierce habits. It twice unprovokedly bit a woodcutter who happened to pass it. The bite, of course, was productive of no consequences except a slight momentary pain."

Colour (in life). A specimen 310 mm. in length was above very dark rich olive-brown, with a bright yellow collar-mark forming an acute backward-pointing angle on the neck; the skin between the scales is brick-red, and shows as fine red reticulations on the anterior part of the body. Labials bright yellow, upper outlined in black. Below, head and neck bright yellow, remainder greyish buff, with small black spots, and a very distinct black spot on the side of each ventral and pair of subcaudal scales.

A specimen 760 mm. in length differed in having no collar-mark and the red reticulations showing only on the neck, also other markings which were hardly distinguishable on the smaller specimen here show, viz. numerous narrow black transverse lines, each interrupted by a dorso-lateral series of dull orange-brown spots. The lower parts of the sides are iridescent crimson, speckled with black, and the belly is yellowish, only shading to greyish buff posteriorly.

The whole lower surface is highly iridescent, with purplish shades. The eye is large and noticeable. Iris, very narrow golden ring round pupil, remainder rich red-brown, with a redder patch above the pupil.

Hab. Eastern Himalayas, Assam, Burma, South China, Malay Peninsula, Sumatra, Nias, Java, Borneo, Palawan, Balabac, Sipora (Mentawei Islands).

116. TROPIDONOTUS MACULATUS Edeling.

Hab. Malay Peninsula (one specimen, Malacca; Blgr. Cat. Snakes, i. p. 260), Sumatra, Labuan, Borneo.

117. MACROPISTHODON FLAVICEPS (D. & B.).

Tropidonotus leucomelas, Günth. Rept. Brit. Ind. p. 271, pl. xxii. fig. I.

Macropisthodon flaviceps, Blgr. Cat. Snakes, i. p. 266.

The type of *T. leucomelas* is supposed to be from Penang. Mr. Wray has obtained this species in Perak.

Hab. Malay Peninsula, Sumatra, Borneo.

118. MACROPISTHODON RHODOMELAS (Boie).

Macropisthodon rhodomelas, Blgr. Cat. Snakes, i. p. 266.

This snake is frequently found in Singapore (*cf.* P. Z. S. 1896, p. 880), and has been recently recorded from Pahang (R. Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 9).

Hab. Malay Peninsula, Sumatra, Java, Borneo, and Celebes (a specimen in the Raffles Museum is said to be from Macassar).

119. HELICOPS SCHISTOSUS (Daud.).

Tropidonotus schistosus, Cantor, p. 91.

Atretium schistosum, Günth. Rept. Brit. Ind. p. 273.

Helicops schistosus, Blgr. Cat. Snakes, i. p. 274.

Hab. Malay Peninsula (Cantor), Ceylon, Southern India, Bengal, Yunnan, Burma.

120. LYCODON AULICUS (L.).

Lycodon aulicus, Blgr. Cat. Snakes, i. p. 352.

Siamese. "Ngu how-peek-kaao," also "Ngu ngaukh."

This little snake, which not unfrequently is found in inhabited houses, is recorded from Penang, Singapore, and the Malay Peninsula. The British Museum Catalogue mentions specimens from Siam, presented by Mr. Newman, and from Cambodia, collected by M. Mouhot. Personally I have obtained this species from Penang (sea-level and at 2200 ft. elevation), from Alor Star, Kedah, and from Bangkok and Chantaboon; all these were of Var. D.

Description. In eleven Siamese and Malay individuals the number of ventral shields varied from 192 to 207, and the subcaudals from 61 to 75. In one specimen from Penang the 4th and 5th subcaudals were single.

Colour (in life).—Var. D. Above brown, with fine, narrow, yellow reticulations; a triangular yellow blotch on each side of the occiput, confluent in the centre, forming a collar; labials yellow, all of them or only the anterior ones spotted with brown. Below uniform white or pale yellow.

Size. A Bangkok specimen measured 540 mm. in total length.

Hab. Ceylon, India, Himalayas, Burma, Siam, Cambodia, Cochinchina, Malay Peninsula, Sumatra, Java, Sumba, Savu, Ombaai, Flores, Timor, Celebes, Philippines, Mascarene Islands (introduced).

N.B.—I know no instance of *Lycodon jara* occurring in Siam;

Dr. Haase's Bangkok specimens of "*L. jara*" that I have examined are undoubtedly *L. aulicus*.

121. LYCODON LAOENSIS Günth.

Lycodon laoensis Günth. Rept. Brit. Ind. p. 317 Blgr. Cat. Snakes, i. p. 354.

Discovered by M. Mouhot in the Laos Mountains.

Hab. Siam.

122. LYCODON EFFRENIS Cant.

Lycodon effrœnis, Cantor, p. 70, pl. xl. fig. 2.
Lycodon effrenis, Blgr. Cat. Snakes, i. p. 356.

Cantor obtained one specimen from Penang Hill.

Hab. Malay Peninsula, Sumatra, Borneo.

123. LYCODON SUBCINCTUS Boie.

Lycodon platurinus, Cantor, p. 96.
Lycodon subcinctus, Blgr. Cat. Snakes, i. p. 359.

Recorded from Penang Hill (Cantor) and Singapore (Brit. Mus. Cat., Hanitsch, Flower). In December 1896 I obtained another specimen in Singapore, 710 mm. in total length. In September 1897 Dr. Wilson gave me a specimen caught in Johore Bahru. And in April 1898 I got two males in the Larut Hills, Perak, at an elevation of 4400 feet (each of which had a recently swallowed lizard, *Lygosoma* sp. incert., in its stomach), one 753 mm. and the other 756 mm. in length.

Colour (in life). Above purplish black, with double white cross-bands. Skin between scales whitish. Below, buff and purplish black; anteriorly the two colours form alternate broad but ill-defined cross-bands, posteriorly they are irregularly mottled.

The similarity in colouring between this harmless snake and one variety of the poisonous *Bungarus candidus* is worthy of notice.

Hab. Malay Peninsula, Sumatra, Nias, Java, Lombok, Borneo, Philippines.

124. DRYOCALAMUS SUBANNULATUS (D. & B.).

Dryocalamus subannulatus, Blgr. Cat. Snakes, i. p. 371.

Recorded from Singapore and Province Wellesley (P. Z. S. 1896, p. 881).

Hab. Malay Peninsula, Sumatra.

125. DRYOCALAMUS DAVISONII (Blanf.).

Hydrophobius davisonii, Blgr. Fauna Brit. Ind., Rept. p. 299 (1890).

Dryocalamus davisonii, Blgr. Cat. Snakes, i. p. 372 (1893).

Siamese. "Ngu plang-nuan."

I have seen three or four specimens from Bangkok; one measured 965 mm. in total length.

Hab. Tenasserim, Siam, Cochinchina, Annam.

126. Zaocys carinatus (Günther).

Zaocys carinatus, Blgr. Cat. Snakes, i. p. 377, pl. xxvii. fig. 1; R. Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 9.

Recorded from Perak and Singapore.

Hab. Malay Peninsula, Sumatra, Borneo.

N.B.—Specimens of the harmless *Zaocys* are sometimes mistaken for the poisonous Hamadryad, *Naia bungarus*. A friend once told me of his having killed two Hamadryads in the Larut Hills, and afterwards showed me the bodies; they were both *Zaocys*, but I cannot say now if they belonged to this or the next species.

127. Zaocys fuscus (Günther).

Zaocys fuscus, Blgr. Cat. Snakes, i. p. 378, pl. xxvii. fig. 2.

Of this fine snake, which has not previously been recorded from the Malay Peninsula, I obtained one specimen, a male, on Penang Hill, at an elevation of 1900 feet, in March 1898. Ventrals 195, subcaudals 160. Total length 2965 mm. (or 9 feet 8¾ inches). In its stomach was a recently swallowed frog, *Megalophrys nasuta*.

Colour (in life). Above olive-brown, with a bright brick-red vertebral line (which faded after death); a black lateral line on the posterior half of the body and on the tail; lower surfaces uniform primrose-yellow. Head above dark olive-brown; 5th, 6th, and 7th upper labials and whole lower jaw primrose-yellow. Scales on upper surface of tail edged with black.

Hab. Malay Peninsula, Sumatra, Natuna, Borneo.

128. Zamenis korros (Schleg.).

Zamenis korros, Blgr. Cat. Snakes, i. p. 384.

This Rat-Snake has been recorded from Penang, Perak, and Singapore (P. Z. S. 1896, p. 882), and M. Mouhot obtained it in Siam.

Recently I have seen seven individuals from the region treated of in this paper: two caught at Bakar Bata (near Alor Star), Kedah; one from Province Wellesley; one from the Kuala Kangsa Pass (between Larut and Kinta) in Perak; one from Kuala Lumpor, Selangor (1568 mm. in total length); one I shot in the jungle near Kabin, Siam; and one was caught at Pachim, Siam, by Mrs. Stanley Flower, which measured 1780 mm. (5 feet 10 inches) in total length, and is the biggest *Z. korros* I have ever seen.

Young specimens may have very distinct narrow yellow cross-bars on the anterior part of the body, which become gradually fainter posteriorly.

Hab. Sikhim Himalayas, Assam, Burma, Western Yunnan, Southern China, Siam, Malay Peninsula, Sumatra, Java.

129. Zamenis mucosus (L.).

Zamenis mucosus, Blgr. Cat. Snakes, i. p. 385.

Siamese. "Ngu how-talaan."

Localities. The Dhaman or Rat-Snake seems to be numerous in Bangkok, and I have come across several specimens, especially in the Wang Na and at Sapatoom. There is a specimen in the British Museum, obtained in Siam by M. Mouhot, and one said to be from Singapore, presented by Dr. Dennys.

Habits. I have more than once seen the Dhaman moving in the open in bright daylight. When newly caught it is fierce and bites hard, and, as the teeth sometimes break off in one's flesh, it may inflict a nasty wound unless the broken-off teeth are at once extracted. When angry it utters repeatedly a curious threatening sound, audible some yards off, best described as "roaring," something like the the deep growling of a big dog.

It also rears up its head like a Cobra and dilates its neck, but not transversely like *Naia* or dorsally, but *ventrally*; the anterior ventral shields are thrust out and become acutely keeled, and the skin on the sides of the neck is widely stretched, showing yellow between the brown scales.

Colour (in life). Above olive-brown or light yellowish brown, shading towards the sides (on the anterior half especially) to very pretty shades of purple and mauve-grey. On specimens up to 1000 mm. in length there are on the anterior half of the body indistinct, narrow, light cross-bands, showing plainest on the sides, and more or less obliterated in the vertebral region. In all specimens, on the posterior part of the body and on the tail, are numerous very distinct but irregular black cross-bands, narrower than the pale brown interspaces. Below pale yellow, the cervical and posterior ventral shields and the subcaudal shields are partially edged with black. Labials yellow, strongly edged with black along the sutures.

Size. An individual from Sapatoom measured 2284 mm. (7 feet 6 inches) in total length, and others were nearly as large.

Hab. Transcaspia, Afghanistan, Cashmere, Nepaul, Sikhim, India, Ceylon, Burma, Formosa, South China, Siam, Malay Peninsula, Java.

130. ZAMENIS SPINALIS (Peters).

Zamenis spinalis, Blgr. Cat. Snakes, i. p. 394.

Hab. Mongolia, Corea, China, Hainan, Siam.

131. ZAMENIS FASCIOLATUS (Shaw).

Zamenis fasciolatus, Blgr. Cat. Snakes, i. p. 404.

Recorded from Province Wellesley (Cantor, p. 72).

Hab. Northern India, Madras, Malay Peninsula.

132. XENELAPHIS HEXAGONOTUS (Cantor).

Xenelaphis hexagonotus, Blgr. Cat. Snakes, ii. p. 8.

Recorded from Penang, Pahang, and Singapore (P. Z. S. 1896, p. 882).

Hab. Burma, Malay Peninsula, Sumatra, Java, Borneo.

133. COLUBER PORPHYRACEUS Cantor.

Coluber porphyraceus, Blgr. Cat. Snakes, ii. p. 34.

The Brit. Mus. Catalogue mentions a specimen from Singapore, from Dr. Cantor.

Hab. Eastern Himalayas, Assam, Burma, Yunnan, Malay Peninsula, Sumatra.

N.B.—COLUBER HODGSONII (Günth.) is recorded from Singapore! [R. Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 10.]

134. COLUBER TÆNIURUS (Cope).

Coluber tæniurus, Blgr. Cat. Snakes, ii. p. 47; Ridley, J. S. B. R. A. S. 1898, p. 99.

This snake has been recently added to the known fauna of the Malay Peninsula by Mr. H. N. Ridley, who obtained specimens in the Batu Caves, near Kuala Lumpor. In June 1898 Mr. A. L. Butler and myself visited these caves and obtained more specimens of this co-called "White Snake." They were far in the hill-side, where no daylight can ever penetrate; one specimen had a recently swallowed bat in its stomach; the largest was 2260 mm. (7 feet 5 inches) in total length. In September 1897 I received a specimen, through the kindness of Dr. Wilson, caught in Johore Bahru, which measured 1657 mm. in length; and, in Sept. or Oct. 1898, I hear Mr. Butler "caught a 'Cave Snake' in a drawer in a rest-house in Selangor on the Pahang track, miles away from any rocks: it is olivaceous in colour."

Hab. Manchuria, China, Sikhim, Cochinchina, Siam, Malay Peninsula, Sumatra, Borneo.

135. COLUBER OXYCEPHALUS Boie.

Herpetodryas oxycephalus, Cantor, p. 80.

Coluber oxycephalus, Blgr. Cat. Snakes, ii. p. 56.

This handsome green Snake is found in the hills of Penang (two specimens recorded by Cantor, and I have seen two in the collection of Mr. van Sommeren), in Larut, Perak (specimen in the Taiping Museum), in Pahang (R. Hanitsch, Rep. Raffles, Libr. & Mus. 1897, p. 10), in Malacca (Peters, Monatsb. Berl. Ac. 1895, p. 269), in Johore (Dr. Wilson gave me a specimen from Johore Bahru), and in Singapore (two specimens in the British Museum from Gen. Hardwicke and one obtained by myself in October 1897).

Hab. Eastern Himalayas, Tenasserim, Malay Peninsula, Java, Borneo, Philippines, Great Natuna Island.

136. COLUBER MELANURUS Schleg.

Coluber melanurus, Blgr. Cat. Snakes, ii. p. 60; S. Flower, P. Z. S. 1896, p. 883.

This snake is found in the hills of Penang (two specimens in Mr. van Sommeren's collection), in Province Wellesley, in Selangor

(several local specimens in the Kuala Lumpor Museum), and in Singapore (Dr. Dennys, Mr. Ridley, Dr. Hanitsch, and myself).

Hab. South China, Burma, Malay Peninsula, Sumatra, Nias, Java, Borneo.

137. COLUBER RADIATUS Schleg.

Coluber radiatus Blgr. Cat. Snakes, ii. p. 61.

Localities. Found in Penang (Cantor and others), Province Wellesley (two specimens in Mr. van Sommeren's collection), Perak (several specimens from Taiping and Kuala Kangsa, in the Taiping Museum), and Singapore (Cantor and Hanitsch).

It does not seem to have been previously recorded from Siam, where I obtained four specimens from Bangkok and one from Ayuthia.

Habits. Like most species of *Coluber*, this is a fierce snake and will bite one vigorously; the neck is apparently dilatable.

Colour (in life). Above yellowish brown, with three black lines along each side of the anterior part of the body: these may be more or less broken up into a series of elongated spots; usually the upper line is broad and conspicuous, and the lowest narrow and indistinct; a well-marked black line across the occiput; three black lines radiating from the eye. Lower parts uniform yellow, or lemon-yellow anteriorly and yellow with pink shades posteriorly (after death, in specimens placed in spirits, dark purplish speckles may appear). In young specimens the anterior half of the body may be indistinctly reticulated with white. Iris bright golden ("bright gamboge, with a concentric black ring"—*Cantor*).

Size. The largest Bangkok specimen was 1696 mm. in total length.

Hab. Eastern Himalayas, Bengal, Assam, Burma, South China, Cochinchina, Siam, Malay Peninsula, Sumatra, Java.

138. GONYOPHIS MARGARITATUS (Peters).

Gonyosoma margaritatum, Peters, Mon. Berl. Ac. 1871, p. 578
Gonyophis margaritatus, Blgr. Cat. Snakes, ii. p. 71.

Hab. Malay Peninsula (Singapore, Blgr. A. M. N. H. (6) viii. 1891, p. 290), Borneo.

139. DENDROPHIS PICTUS (Gmel.).

Leptophis pictus, Cantor, p. 82.
Dendrophis pictus, Blgr. Cat. Snakes, ii. p. 78.

Localities. The Painted Tree-Snake is by no means rare; it has been found in Penang (Cantor), on Penang Hill at 2000 feet (S. S. F.), at Alor Star and at Kulim, Kedah (S. S. F.), at Taiping, Perak (S. S. F.), at Kuala Lumpor, Selangor (Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 10), at Tanglin, Singapore (S. S. F.), in Siam (Siamese Museum), in the Laos Mountains (Mouhot), and in Cambodia (Mouhot).

Habits. In the stomach of one I found a frog, *Rana macrodactyla*, which indicates that this snake is not entirely arboreal, as

R. macrodactyla is a marsh-haunting species. *Dendrophis pictus* is very gentle when handled.

Colour (in life). Above olive bronze-brown; a black line on either side of the head from the nostril passing through the eye and continued along the anterior quarter of the body, where it is broken at frequent and regular intervals by diagonal bands of rich blue-green. Along each side of the body is a pale whitish bronze line, bordered above and below by rich dark brown. These lateral lines disappear on the tail, which is plain olive-brown above and on the sides. The upper labials and sides of the neck below the black line are pale lemon-yellow. The ower surfaces of head, body, and tail are immaculate white; the lateral ventral keels are finely outlined in dark brown; and the sides of the ventral shields above the keels are white, with very pretty pink and bronze shades. Iris bronze. Tongue red, with black tip.

Hab. Eastern Himalayas, Bengal, hills of Southern India, Burma, Siam, Cambodia, Malay Peninsula, Sumatra, Nias, Linga, Java, Lombok, Flores, Ombaai, Great Natuna Island, Borneo, Sulu Islands, Celebes, Ceram, Misol, Ternate, Philippines.

140. DENDROPHIS FORMOSUS Boie.

Dendrophis formosus, Blgr. Cat. Snakes, ii. p. 84.

Localities. This handsome snake is found on Penang Hill (one specimen in Mr. van Sommeren's collection, and one obtained by, myself at 2200 feet), at Kuala Lumpor, Selangor (R. Hanitsch Rep. Raffles Libr. & Mus. 1897, p. 10), in Malacca (Brit Mus. Cat.), and in Singapore (R. Hanitsch, *op. cit.* p. 10, and S. Flower, P. Z. S. 1896, p. 883).

Colour (in life). A specimen 1422 mm. (4 feet 8 inches) long, caught on Penang Hill, 2nd April 1898, differed somewhat from the Singapore specimen described in P. Z. S. 1896, p. 883. Its colours were as follows :—

Top of head and enlarged row of vertebral shields rich red-brown; posterior border of each of these shields black. Upper parts of sides of body yellowish brown with red and green shades, each scale edged posteriorly with black; the skin between the scales is bright ultramarine-blue and shows distinctly on the sides of the neck. The back becomes less brown posteriorly and more yellow, finally turning to green on the tail. A broad black line from the muzzle passing through the eye to the nape, where it converges with but does not meet its fellow; the two run back parallel along the neck and soon disappear. Labials and under surface of head and neck bright greenish yellow. The lowest row of scales on each side of the body and the ventrals are bright grass-green. The lateral ventral keels and subcaudal shields are not outlined in black. Iris sea-green, with broad, black, horizontal line through it. Tongue red, black tip.

Hab. Malay Peninsula, Sumatra ("Sungei Mandan, Sumatra," R. Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 10), Java, Borneo.

141. DENDRELAPHIS CAUDOLINEATUS (Gray).

Leptophis caudolineatus, Cantor, p. 85.
Dendrelaphis caudolineatus, Blgr. Cat. Snakes, ii. p. 89.

Recorded from Penang, Perak, Pahang, and Singapore (P. Z. S. 1896, p. 884).

Hab. Southern India, Mergui, Malay Peninsula, Sumatra, Nias, Sipora (Mentawei Islands). Natunas, Borneo, Philippines.

142. SIMOTES PURPURASCENS (Schleg.).

Xenodon purpurascens, Cantor, p. 67.
Simotes catenifer, Stol. J. A. S. B. 1873, p. 121, pl. xi. fig. 3.
Simotes dennysi, Blanford, P. Z. S. 1881, p. 218, pl. xxi. fig. 1.
Simotes purpurascens, Blgr. Cat. Snakes, ii. p. 218.

Localities. Cantor's specimen from Penang Hill belongs to var. C, with 21 rows of scales.

Var. B, with 19 rows of scales, is recorded from Johore (Stol.), Pahang (Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 10), and Singapore (Brit. Mus. Cat. and Hanitsch, *op. cit.* p. 10). And I have obtained specimens from Penang Hill, at 2000 and 2500 feet elevation.

Colour (in life). Above dark brown, shading to *deep purple* on the sides, with about sixteen blotches along the back, each narrowly edged with black and reddish yellow. Head yellowish brown, with characteristic *Simotes* black symmetrical lines and small spots. Below *pinkish buff*. Many of the ventrals on the posterior part of the body and the anterior subcaudals are *purplish grey*.

Size. A Penang specimen measured 698 mm. in total length, but one from Sipora has been recorded of 950 mm. (3 feet, 1½ inches).

[Blgr. Ann. Mus. Genova (2) xiv. 1894, p. 616.]

Hab. South China, Cochinchina, Siam, Malay Peninsula, Sumatra, Nias, Sipora (Mentawei Islands), Java, Borneo.

143. SIMOTES CYCLURUS (Cantor).

Simotes bicatenatus, Stol. J. A. S. B. 1873, p. 114.
Simotes fasciolatus, Günth. Rept. Brit. Ind. p. 218, pl. xx. fig. B.
Simotes cochinchinensis, Günth. *l. c.* p. 219, pl. xx. fig. C.
Simotes cyclurus, Blg. Cat. Snakes, ii. p. 219.

There are specimens of var. E. mentioned in the British Museum Catalogue from Pachebone and the Laos Mountains, collected by M. Mouhot, and from Siam, presented by Mr. Newman.

I have observed five individuals caught in Bangkok, all belonging to var. E (scales in 21 rows). The largest, a male, was in total length 806 mm. The ventrals (numbered respectively 161, 162, 170, 170, and 174, and the subcaudals (which are double, with the exception specified) 43, 43, 45 (5th single), 53 and 41. One specimen had only 7 upper labials, the 4th entering the eye; the remainder had 8 upper labials, the 4th and 5th entering the eye.

One specimen had only one anterior temporal on one side.

This variety had no longitudinal lines or ventral spots, but about 17 dark transverse marks on the body and tail.

Hab. Bengal, Assam, Burma, South China, Cochinchina, Siam, Malay Peninsula, and Sumatra.

N.B.—SIMOTES VIOLACEUS (Cantor).

Simotes violaceus, Blgr. Cat. Snakes, ii. p. 222.

This species was obtained in Cambodia by M. Mouhot, so will probably be eventually found in Siam.

Hab. Bengal, Assam, Burma, Cambodia, South China.

144. SIMOTES OCTOLINEATUS (Schneid.)

Simotes octolineatus, Blgr. Cat. Snakes, ii. p. 224; S. Flower, P. Z. S. 1896, p. 884.

Recorded from Perak and Singapore.

Hab. Southern India, Malay Peninsula, Sumatra, Java, Borneo, Sulu Islands.

145. SIMOTES SIGNATUS Günther.

Simotes signatus, Blgr. Cat. Snakes, ii. p. 226.

Hab. Malay Peninsula (Singapore, Brit. Mus. Cat.), Sumatra, Java.

146. SIMOTES TÆNIATUS Günther.

Simotes tæniatus, Günth. Rept. Brit. Ind. p. 216, pl. xx. fig. A; Blgr. Cat. Snakes, ii. p. 227.

Siamese. "Ngu kow-pe-kow."

Localities. This species was discovered by M. Mouhot in Cambodia, and specimens from Siam have also reached the British Museum through Sir R. Schomburgk and Mr. Newman.

I obtained three individuals in Bangkok, and one near Bortong Kabin, up the Bangpakong river.

Habits. It feeds sometimes on the small frog *Microhyla ornata*.

Popular belief. The Siamese greatly dread this snake, considering it poisonous; and they say, though it cannot kill a man, its bite will render him dumb and speechless for the rest of his life.

Description. Two of these Siamese specimens had 17 rows of scales and two 19.

Colour (in life). Above olive-brown; a very narrow pale yellow vertebral line; on each side of this two very dark brown longitudinal lines, more or less broken up into a series of spots. Below bright coral-red, with, on either side, a row of triangular (apex pointing forward), semicircular, or squarish black spots; the under surface of the tail is immaculate bright coral-red. Between the brown of the upper parts and the red belly there is on either side a pale yellowish-white line. Head ornamented with characteristic *Simotes* marks, black with narrow pale yellow margins; under surface of head pale yellow.

Size. The largest specimen, a female from Bangkok, measured 330 mm. in total length.

Hab. Siam, Cambodia, Cochinchina.

147. SIMOTES CRUENTATUS Günther.

Simotes cruentatus, Blgr. Cat. Snakes, ii. p. 231, pl. x. fig. 1.

Hab. Burma, Malay Peninsula (Stol. J. A. S. B. 1873, p. 121).

148. ABLABES TRICOLOR (Schleg.).

Ablabes tricolor, Blgr. Cat. Snakes, ii. p. 281.

Found in Singapore by Mr. Ridley, and I got a specimen near the foot of Government Hill, Penang, in April 1898; it was a gentle snake, 468 mm. in total length.

Hab. Malay Peninsula, Sumatra, Borneo, Java.

149. ABLABES BALIODIRUS (Boie).

Coronella baliodeira, Cantor, p. 66.

Ablabes baliodirus, Blgr. Cat. Snakes, ii. p. 283.

Cantor obtained two specimens from the hills of Penang; he says "it is of fierce habits." Mr. Ridley informs me he caught an *Ablabes baliodirus* on the top of Bujang Malacca, in Perak, in Sept. or Oct. 1898.

Hab. Malay Peninsula, Sumatra, Java, Natuna Islands, Borneo.

150. ABLABES LONGICAUDA Peters.

Ablabes longicauda, Blgr. Cat. Snakes, ii. p. 284.

Mr. C. Curtis, Superintendent of the Botanical Gardens, Penang, kindly gave me a specimen of this apparently rare snake, which he had found alive in a tin box in his house in the suburbs of Georgetown, Penang, during March or April 1898.

Hab. Malay Peninsula, Sumatra, Borneo.

151. MACROCALAMUS LATERALIS Günther.

Macrocalamus lateralis, Günth. Rept. Brit. Ind. p. 199, pl. xviii. fig. D; Blgr. Cat. Snakes, ii. p. 327.

This species was known from a single specimen (from General Hardwicke's East Indian collection) of doubtful locality. In April 1898 I was fortunate enough to get three individuals in the Larut Hills, Perak, at an elevation of 4400 feet.

Description. These three specimens agree with the description of *M. lateralis*, except that they possess a loreal shield, larger than deep; the type-specimen was apparently abnormal in having the loreals united with the præfrontals. The numbers of ventral and subcaudal shields were respectively 110 and 25, 110 and 27, 119 and 21.

Colour. Above rich dark reddish brown. Below, head and neck yellow, remainder bright coral-red, with a black latero-ventral line, clearly defined from the under surface of the neck to the tip of the tail on each side.

Labials and sides of neck yellow; a dark mark below eye and another behind it running obliquely to angle of mouth, and another similar but larger mark on the neck.

Size. These specimens were 193 mm., 212 mm., and 222 mm. in length.

Hab. Malay Peninsula.

152. PSEUDORHABDIUM LONGICEPS (Cantor).

Pseudorhabdium longiceps, Blgr. Cat. Snakes, ii. p. 329.

Recorded from Penang, Perak, and Singapore (P. Z. S. 1896, p. 886).

Hab. Malay Peninsula, Sumatra, Borneo, Celebes, Philippines.

153. CALAMARIA ALBIVENTER (Gray).

Calamaria linnæi, var., Cantor, p. 62.
Calamaria albiventer, Blgr. Cat. Snakes, ii. p. 336.

Of this very handsome snake I got a specimen, 279 mm. long, on Penang Hill, elevation 2000 feet, in March 1898. Its colours were very distinct and pretty.

Colour (in life). Above rich red-brown, with a pair of black-edged bright red vertebral lines; on each side a black-edged bluish-white line. Upper surface of head rich red-brown, finely speckled with black. Under surface of head rich lemon-yellow, which gradually shades into red on the neck; remainder of lower surface bright coral-red. A median black line under the tail.

Hab. Malay Peninsula.

154. CALAMARIA SUMATRANA Edeling.

Calamaria sumatrana, Blgr. Cat. Snakes, ii. p. 339.

Hab. Malay Peninsula (Singapore, W. L. Sclater, J. A. S. B. lx. 1891, p. 233) and Sumatra.

155. CALAMARIA LEUCOCEPHALA D. & B.

Calamaria lumbricoides, var. Cantor, p. 61.
Calamaria leucocephala, Blgr. Cat. Snakes, ii. p. 344.

Localities. Of this species, already recorded from Penang and Singapore, I obtained four specimens on Penang Hill, at elevations of about 2200 feet, and one at the mouth of the Batu Caves, near Kuala Lumpor, Selangor.

Habits. Two were found under a water-butt near a house; when disturbed they were fierce, striking and threatening with wide-opened mouth.

Colour (in life). These snakes are highly iridescent, and the line of demarcation between the dark upper and light lower parts is sharply defined: upper parts rich dark brown, purplish blue, or blackish; lower parts uniform white, buff, or very pale purplish blue, with a more or less indistinct zigzag median dark line under the tail. Head and neck bright lemon- or sulphur-yellow; on the top of the head there may be a symmetrical chestnut-coloured

mark which shows the bright yellow ground-colour through breaks in it and which does not join on to the dark upper parts, or else this mark may be a duller brown and larger and joined to the dark upper parts either narrowly (only in the vertebral line) or broadly.

Size. These five specimens varied from 265 to 293 mm. in total length.

Hab. Malay Peninsula, Sumatra, Java, Borneo.

156. CALAMARIA PAVIMENTATA D. & B.

Calamaria pavimentata, Blgr. Cat. Snakes, ii. p. 348; S. Flower, P. Z. S. 1896, p. 886.

M. Mouhot obtained a specimen of this snake in Siam and two in the Laos Mountains; these form the types of *Calamaria siamensis* Günth. In April 1898 I saw three more individuals from Penang Hill, one caught at about 800 feet, the others at about 2000 feet.

Hab. Burma, Siam, Cochinchina, Canton, Malay Peninsula, Java

Series **Opisthoglypha.**

Subfamily HOMALOPSINÆ.

157. HYPSIRHINA INDICA (Gray).

Hypsirhina indica, Blgr. Cat. Snakes, iii. p. 4, pl. i. fig. 1.

The only known specimens, the types in the British Museum, are supposed to be from the Malay Peninsula.

Hab. Malay Peninsula?

158. HYPSIRHINA PLUMBEA (Boie).

Hypsirhina plumbea, Blgr. Cat. Snakes, iii. p. 5.

Localities. The British Museum Catalogue mentions specimens from Pachebone, Siam (Mouhot), and from Penang (Cantor, Hardwicke). I obtained one near Taiping, Perak, in Dec. 1899; two near Tahkamen, Siam, in March 1897; and one near Alor Star, Kedah, in May 1898.

Habits. This snake apparently usually frequents freshwater-ponds or rivulets, but one I found under a stone some little distance from any water. When frightened, this species will bite fiercely at anything within reach.

Colour (in life). Above dark olive-brown, with small irregular, scattered, black spots, and in one specimen (from Kedah) a series of small black spots along the vertebral line of the neck, and a black spot on either side of the head above the angle of the mouth. Lips and whole lower surface bright chrome- or saffron-yellow. A dark brown zigzag median line under the tail.

Size. An individual from Tahkamen measured in total length 411 mm.

Hab. Burma, South China, Formosa, Hainan, Siam, Malay Peninsula, Java, Borneo, Celebes.

159. HYPSIRHINA JAGORII Peters.

Hypsirhina jagorii, Blgr. Cat. Snakes, iii. p. 6.

The British Museum Catalogue mentions specimens from Siam received through M. Mouhot, Sir R. Schomburgk, and Mr. W. H. Newman. I obtained three in Bangkok and one at Tahkamen, the latter 635 mm. in total length.

Hab. Siam.

160. HYPSIRHINA ENHYDRIS (Schneid.).

Hypsirhina enhydris, Blgr. Cat. Snakes, iii. p. 6.

Siamese. "Ngu pla"="fish-snake," also applied to other species of Homalopsine snakes. This species has been recorded from Penang and Singapore. I obtained one specimen from near Alor Star in Kedah, and two in Bangkok, all belonging to var. A.

Colour (in life). The Kedah specimen was coloured as follows:—Above dark olive-brown, with indistinct black longitudinal lines and dark yellowish-olive dorso-lateral lines. Beneath pale yellow, with brown median ventral line, interrupted at the suture of each ventral shield, but uninterrupted and darker under the tail; on each side two brown ventro-lateral lines, the lower one much darker than the upper. Lips yellow.

Hab. India, Ceylon, Burma, South China, Cochinchina, Siam, Malay Peninsula, Borneo, Celebes.

161. HYPSIRHINA CHINENSIS Gray.

Hypsirhina chinensis, Blgr. Cat. Snakes, iii. p. 8, pl. i. fig. 2.

Hab. China, Siam.

162. HYPSIRHINA BOCOURTII Jan.

Hypsirhina bocourtii, Blgr. Cat. Snakes, iii. p. 10.

Of this species, which was not previously recorded from the Malay Peninsula, I obtained an adult female, 854 mm. in total length, near Alor Kedah, in June 1898, who while in captivity brought forth seventeen young, alive. They were expelled at intervals of from ten to twenty minutes; between whiles she lay quite still, as if exhausted. The young came out head foremost, and were very lively as soon as born, perfectly "at home" in the water, swimming with ease and speed, but very awkward and sluggish on land; as soon as born they proceeded to change their skin. If picked up gently in the hand they were perfectly tame and quiet, but if surprised or pinched they bit with promptitude and vigour. Some new-born young of *Hypsirhina enhydris* which Cantor observed "refused fishes and aquatic insects" and eventually "expired from inanition"; but these young *H. bocourtii* fed freely on small frogs (*Rana* and *Microhyla*) when only a day or two old. The new-born young were about 220 mm. in length.

Colour (in life). ♀. Above very dark olive-brown, with dark yellow spots forming longitudinal lines, and more or less irregular, black-edged, dark yellow, narrow cross-bars. Lips dull yellow, each

scale black-edged. Beneath dull yellow, with vertical black bars interrupted on the ventral line except under the tail.

Hab. Siam, Malay Peninsula.

163. HYPSIRHINA SIEBOLDII (Schleg.).

Hypsirhina sieboldii, Blgr. Cat. Snakes, iii. p. 11.

Hab. India, Burma, Malay Peninsula.

164. HOMALOPSIS BUCCATA (L.).

Homalopsis buccata, Blgr. Cat. Snakes, iii. p. 14 (skull fig.).

Siamese. "Ngu-pla"="fish-snake."

Localities. This snake has been recorded from Penang, Malacca, and Singapore (*vide* P. Z. S. 1896, p. 887). There are specimens from Perak in the Taiping Museum. I obtained two near Alor Star, Kedah, and about twelve specimens in Bangkok. A specimen in the Siamese Museum has two heads, side by side, each about equally perfectly developed.

Habits. H. buccata frequents the neighbourhood of water, in which it spends most of its time, and is an expert swimmer; "it feeds on fishes" (Cantor). When first caught it is very wild, but becomes quite tame in two or three days. I have kept several individuals in captivity, one for 14 months, when it was set at liberty on my leaving Siam. They appeared to have more intelligence than most snakes and appreciated being petted: when I came to the tank in which they were kept they would often of their own accord come to me and climb up my arm and remain round my neck or curled up in a pocket sometimes for hours till replaced in the tank, while they resented being touched by anyone else, which was remarkable, for other snakes that I have kept as pets never objected to being picked up by one anyone (who was used to handling snakes). Their food in captivity was frogs (*Rana limnocharis*).

Colour (in life). *Homalopsis buccata* is a remarkably pretty snake on account of the richness of its colours and the bold, handsome markings. The following description is of adult specimens from Bangkok:—

Above with broad transverse rich chocolate-brown cross-bands narrowly edged with black, separated by narrow pale greyish-brown interspaces; on the anterior part of the body these interspaces are alternately complete and broken up into three parts. An irregular spot on the centre of the back, and an acutely pointed wedge (pointing upward) on each side. Head pale brown, with a V-shaped dark brown mark on the snout, and a Λ-shaped mark on the top of the head, which on each side sometimes joins a dark brown line which begins in front of and passes through the eye and continues backward till it joins the first dark transverse band on the neck, which band has a prolongation forward in the vertebral line; a narrow brown black-edged line which reaches as far as the posterior branches of the Λ or sometimes enters the angle. Belly pure

Description.

No.	Locality.	Ventrals.	Sub-caudals.	Frontal	Loreal	Præ-oculars.	Post-oculars.	Sub-oculars.	Upper labials.	Length.	Scales.
										mm.	
1.	Bangkok.	176	93	divided.	entire.	1	2	3	11+12	340	about 40
2.	„	174	98	.....	.....	.....	.....	.....	.....	931	45
3.	„	174	96	divided.	entire.	1	2	3	.....	355	about 48
4.	„	171	106	.....	.....	.....	.....	.....	.....	536	41
5.	„	171	88	.....	entire.	1	2	3	12+12	690	
6.	„	171	88	divided.	entire.	1	2	3	12+12	540	about 45
7.	„	170	101	divided.	entire.	1	2	3	12+12	.....	45
8.	„	168	88	.....	.....	.....	.....	.....	.....	870	45
9.	Kedah.	161	77	.....	.....	.....	.....	.....	.....	285	38
10	„	158	79	.....	.....	.....	.....	.....	.....	260	41

white, with a series of small black spots along each side; the white belly gradually shades to a very rich lemon-yellow on each side, where the dark upper markings commence abruptly. The under surface of the tail is extensively marked with very dark brown. Young specimens from Kedah were marked as above, but the chocolate-brown cross-bands were darker, the interspaces bright yellow-ochre, and the whole lower surface lemon-yellow (*cf.* Cantor, p. 96).

Hab. Burma, Siam, Cambodia, Malay Peninsula, Sumatra, Java, Borneo.

165. CERBERUS RHYNCHOPS (Schn.).

Cerberus rhynchops, Blgr. Cat. Snakes, iii. p. 16; S. Flower, P. Z. S. 1896, p. 888.

Localities. Recorded from Penang, Singapore, and Kuala Lumpor (R. Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 10). I have also obtained it from Johore Bahru, and from Alor Star, Kedah.

Habits. I can only confirm Cantor's remarks: "In the Malayan countries this species occurs in numbers in rivers, estuaries, and . . sea-coasts. It feeds upon fishes. It is of peaceful habits."

Hab. India, Ceylon, Burma, Lower Siam, Malay Peninsula, Sumatra, Engaño, Sipora (Mentawei Islands), Linga, Java, Flores, Sumba, Borneo (I obtained six specimens at Brunei), Celebes, N. Ceram, Philippines, and the Pelew Islands.

166. FORDONIA LEUCOBALIA (Schleg.).

Homalopsis leucobalia, Cantor, p. 102.

Fordonia leucobalia, Blgr. Cat. Snakes, iii. p. 21.

Dr. Hanitsch obtained a specimen in Singapore in October 1898.

Hab. Rivers and coasts of Bengal, Burma, Malay Peninsula, Cochinchina, Nicobars, Java, Borneo, N. Ceram, New Guinea, North Australia.

167. CANTORIA VIOLACEA Gir.

Cantoria violacea, Blgr. Cat. Snakes, iii. p. 23.

A specimen of this very rare snake was caught in the town of Singapore in August 1898 and sent to the Raffles Museum; Dr. Hanitsch very kindly submitted it to me for identification.

Ventral shields 284 (last divided). Anal divided. Subcaudals double, 52. Scales in 19 rows. Length 1220 mm.

The white transverse bands were very narrow.

Hab. Burma, Malay Peninsula, Borneo.

168. HIPISTES HYDRINUS (Cantor).

Homalopsis hydrina, Cantor, p. 104, pl. xl. fig. 4.

Hipistes hydrinus, Blgr. Cat. Snakes, iii. p. 24.

Recorded from the coasts of Penang and Kedah, and from Singapore. The British Museum Catalogue mentions a specimen

from Bangkok. In the Kuala Lumpor Museum there is a specimen caught at Pulo Angsa, on the coast of Selangor.

Hab. Mouths of rivers and coasts of Pegu, Siam, and Malay Peninsula.

169. HERPETON TENTACULATUM Lacép.

Herpeton tentaculatum, Blgr. Cat. Snakes, iii. p. 25.

Siamese. "Ngu kra-dahng."

There is in the Siamese Museum a specimen of this singular snake labelled "Siam," and I obtained two more, caught in different parts of the town of Bangkok. The larger, about 630 mm. in length, had recently swallowed a fish when caught. In life the tentacles on the snout are soft, capable of expansion and retraction, and apparently very sensitive; the snake constantly moves them about, as if they performed the function of the antennæ of Arthropods. Why this particular reptile is thus furnished it is difficult, in our present state of knowledge, to imagine, seeing that other snakes use their tongue as a feeler. When the specimen is placed in spirits the tentacles retract and are not so conspicuous as they are in life.

Hab. Siam, Cochinchina.

Subfamily DIPSADOMORPHINÆ.

170. DIPSADOMORPHUS MULTIMACULATUS (Boie).

Dipsadomorphus multimaculatus, Blgr. Cat. Snakes, iii. p. 63.

Cantor mentions this species from the hills of Penang and the Peninsula, and M. Mouhot obtained a specimen at Pachebone, Siam. There is one in the Siamese Museum labelled "Siam," and I obtained another in Bangkok, 625 mm. in length, with 19 rows of scales.

Hab. Burma, South China, Siam, Malay Peninsula, Sumatra, Java, Celebes.

171. DIPSADOMORPHUS GOKOOL (Gray).

Dipsadomorphus gokool, Blgr. Cat. Snakes, iii. p. 64.

Hab. Bengal, Assam, Malay Peninsula.

172. DIPSADOMORPHUS DENDROPHILUS (Boie).

Dipsadomorphus dendrophilus, Blgr. Cat. Snakes, iii. p. 70.

"Ular Puntee" of the Malays of Kedah.

Localities. Var. B: Recorded from Kedah, Penang, Pangkor (Dindings), Ipoh district of Perak (R. Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 10), and Singapore.

Habits. A specimen I obtained from Kudat, British North Borneo, 1224 mm. in length, looked very distended, and we found in its stomach a recently swallowed Tree-Snake (*Chrysopelea ornata*), which was rather longer than itself; the swallowed prey was, as

usual, head foremost, but the tail and posterior part of the body was for about a third of its length doubled back on the remainder.

Colour (in life) of a specimen from Alor Star, Kedah :— Above intense shining black, below leaden blue-black. Fifty-five bright gamboge-yellow rings, much narrower than the black interspaces, and interrupted both above and below (except the last few on the tail). Labials and lower parts of head and neck gamboge; upper labials broadly, lower labials narrowly outlined in black.

Size. Total length 2310 mm. (P. Z. S. 1896, p. 889).

Hab. Lower Siam, Malay Peninsula, Sumatra, Java, Borneo, Celebes, Palawan, Philippines.

173. DIPSADOMORPHUS JASPIDEUS (D. & B.).

Dipsadomorphus jaspideus, Blgr. Cat. Snakes, iii. p. 73.

Hab. Malay Peninsula (Penang), Java, Borneo.

174. DIPSADOMORPHUS DRAPIEZII (Boie).

Dipsadomorphus drapiezii, Blgr. Cat. Snakes, iii. p. 74; S. Flower, P. Z. S. 1896, p. 889.

Hab. Malay Peninsula, Sumatra, Java, Borneo.

175. DIPSADOMORPHUS CYNODON (Boie).

Dipsadomorphus cynodon, Blgr. Cat. Snakes, iii. p. 77.

Localities. Penang Hills, 2500 feet (Van Sommeren collection), Province Wellesley (Cantor), Gunong Keledang in Perak (" light coloured, with yellow throat," Ridley), Kuala Lumpor (Selangor Museum), Malacca (var. B, British Museum), Johore Bahru (Wilson), and Singapore (vars. A. & B, Dennys and Ridley).

Habits. One was caught in Penang climbing in a coniferous tree. A specimen caught in Johore had swallowed a bird.

Size. A Johore specimen measured in total length 2448 mm. (or 8 feet); two Selangor specimens were of about the same size.

Hab. Assam, Burma, Malay Peninsula, Sipora (Mentawei Islands), Java ?, Bali, Borneo, Philippines.

176. PSAMMODYNASTES PULVERULENTUS (Boie).

Psammodynastes pulverulentus, Blgr. Cat. Snakes, iii. p. 172.

M. Mouhot obtained a specimen in the Laos Mountains. There is one in the Siamese Museum labelled " Siam," and I have seen another from Chantaboon.

Hab. Eastern Himalayas, Khasi and Assam Hills, Burma, Siam, Formosa, Malay Peninsula, Sumatra, Engaño, Java, Lombok, Flores, Great Natuna, Borneo, Celebes, Balabac, Palawan, Philippines.

177. DRYOPHIS XANTHOZONA Boie.

Dryophis xanthozona, Blgr. Cat. Snakes, iii. p. 180.

Hab. Malay Peninsula (Penang), Java.

178. DRYOPHIS PRASINUS Boie.

Dryophis prasinus, Blgr. Cat. Snakes, iii. p. 180; S. Flower, P. Z. S. 1896, p. 890.

"Ular poocho" of the Malays of Kedah.

"Ngu kee-o pah-king-kop" of the Siamese (this term is also applied to *Dryophis mycterizans*).

I have obtained this elegant Tree-Snake from Alor Star, Kedah, from Penang (sea-level to 2500 feet), from Johore Bahru, and from Singapore; and seen specimens from Selangor and Pahang.

Habits. Cantor says of this species, "The very young ones are as gentle as those of a more advanced age are ferocious." However, a specimen 1314 mm. in length (that is to say an average-sized adult) we kept in captivity for three months was always most gentle and never attempted to escape, living at liberty in the drawing-room, usually among the leaves of a small palm which stood on a table, but sometimes going to the window to bask in the sun; and larger specimens even when first caught were perfectly gentle and tame.

Hab. Eastern Himalayas, Assam, Burma, Cambodia, Lower Siam, Malay Peninsula, Sumatra, Nias, Sipora (Mentawei Islands), Java, Lombok, Great Natuna, Borneo (I obtained a specimen at Kudat), Celebes, Ternate, Philippines.

179. DRYOPHIS MYCTERIZANS (L.).

Dryophis mycterizans, Blgr. Cat. Snakes, iii. p. 182.

The British Museum Catalogue mentions a specimen from Siam. I have seen five from Bangkok, the largest about 1200 mm. in length; this snake was as gentle as *D. prasinus*.

Hab. India, Ceylon, Burma, Siam.

180. DRYOPHIOPS RUBESCENS (Gray).

Chrysopelea rubescens, Stoliczka, J. A. S. B. xxxix. 1870, p. 195.

Dryophiops rubescens, Blgr. Cat. Snakes, iii. p. 194.

Hab. Siam, Malay Peninsula, Sumatra, Sipora (Mentawei Islands), Sirhassen (Natuna Islands), Borneo.

181. CHRYSOPELEA ORNATA (Shaw).

Chrysopelea ornata, Blgr. Cat. Snakes, iii. p. 196.

The Ornate Tree-Snake is one of the most beautiful and most frequently seen reptiles in Siam and the Malay Peninsula.

Localities. Var. A: Cantor and Stoliczka record it from Penang, where I obtained two specimens at sea-level and saw a third in Mr. Van Sommeren's collection caught on the hill at an elevation of 2500 feet. It is also known from Kulim in Kedah (S. S. F.), Jelebu (Hanitsch), Kuala Lumpor (Van Sommeren coll.), and Singapore (Dennys, Hanitsch, Ridley, and S. S. F.).

Var. D: The British Museum Catalogue mentions two specimens from Siam presented by Bowring and one from the Laos Mountains collected by Mouhot. I obtained 19 individuals in Bangkok, 2 at

Ayuthia, 1 near Muok Lek in the Dong Phya Fai (elevation 900 feet), 1 at Pachim, 1 at Tahkamen, 1 at Kabin, 1 at Chantaboon, and 3 at Alor Star, Kedah, which is the most southern point where I have seen this variety. A little more to the south, at Kulim and Penang, it seems to be entirely replaced by var. A.

Description.

No.	Locality.	Ventrals.	Last ve tral.	Subcaudals.	Length.
Var. A.					mm.
1.	Singapore	226	?	?	635
2.	Penang	237	Divided.	136	747
3.	Kulim, ♂	238	?	?	911
4.	Singapore	228	Divided.	129	1235
Var. D.					
5.	Bangkok.....	227	Divided.	123	672
6.	Alor Star	228	„	125	838
7.	„ „	226	„	136	889
8.	Dong Phya Fai ...	218	„	111	990
9.	Tahkamen	224	„	123	1185
10.	Bangkok.....	227	„	119	1198
11.	„	230	„	121	1243
12.	„ ♀	239	„	118	1358
13.	„	231	„	74 (tip lost)	1393
14.	„	231	„	79 (tip lost)	1443
15.	„	231	„	79 (tip lost)	1459 (or 4′ 9″·25).

Habits. *Chrysopelea ornata* is the fiercest snake I have met. Under circumstances when most snakes, harmless and poisonous alike, would try to glide away quietly, this one will turn to attack the person who disturbs it, and will attempt to resist capture to the uttermost, striking and biting ferociously. I have not found the slightest effect on myself from its bite, but it is supposed to have a poisonous effect on the small animals on which it feeds, and, so far as my observations go, its bite has the effect of stupefying lizards to some extent (*cf.* Boulenger, Fauna Brit. Ind., Reptiles, pp. 223 and 277).

Individuals I have at various times tried to keep in captivity showed no signs of becoming tamer, and would always bite my hand when I put it in the vivarium, and being also an annoyance to the other inmates of the cage, I have only kept them for a few days at a time. One *Chrysopelea* bit itself so hard that its teeth became fixed in the side of its body.

This snake is diurnal in its habits, and may be seen moving about in the hottest midday sunshine. I remember only once seeing one on the ground, where it was moving from among some bushes to another clump. Usually it frequents trees, and about seven times

I have come across it in buildings, where it not unfrequently takes up its abode in the roof, finding doubtless a good supply of food there, as the lamps attract insects, the insects supply regular food to numerous geckoes, and the geckoes in turn support the snakes. Its cast-off skins (which are decidedly pretty, as, though no trace of the green colour remains, the black markings both on the head and dorsal shields are very distinct) hanging among the rafters often show that a house is tenanted by this snake. Once we came on a large specimen crawling round an old image of Buddha in a temple at Ayuthia; in the dim light it was a curious sight, not easily forgotten.

It is a very active and agile snake. Once I saw a small one, about 2½ feet long, take a flying leap, from an upstairs window, downward and outward on to a branch of a tree and then crawl away among the foliage. The distance it had jumped was measured and found to be nearly 8 feet.

I have known it eat *Hemidactylus frenatus* and *Gecko verticillatus*; the latter may give battle to the snake for some hours before being finally swallowed. Cantor says its prey consists of lizards (*Geckonidæ*) and frogs, and mentions an instance of its eating *Ptychozoon homalocephalum*.

Chrysopelea ornata itself, however, sometimes falls a victim to other snakes; I have known individuals to have been swallowed by a *Zamenis mucosus* and by a *Dipsadomorphus dendrophilus*.

Cantor's experience of this species was quite different from mine, as he writes of its habits:—"It is but seldom seen in trees; it is more frequently found on the ground in the grass. It differs from the other species . . . in its gentleness. The young ones never attempt to bite, the adult but seldom." Günther (Rept. Brit. Ind. p. 299) quotes Cantor's account, adding to the "seldom seen in trees" the very true remark, "probably because it makes too rapid a retreat to be seen." Günther also mentions having "found geckoes in its stomach." Boulenger (Fauna Brit. Ind., Reptiles, p. 372) writes: "It feeds almost exclusively on geckoes, and is of gentle disposition."

Colour (in life). The general colour of "this most beautiful of all snakes" (*Günther*) is bright grass-green, with conspicuous black transverse marks on the top of the head.

Var. A: Bright grass-green, extensively marked with black, so that the back appears black with small green spots. Down the centre of the back is a series of tetraplous bright red spots (in a specimen from Penang Hill these were yellow). Each ventral and subcaudal shield is outlined in black. Head bright sulphur-yellow, boldly marked with black above. "Iris and tongue black" (*Cantor*).

Var. D: The whole body and tail, above and below, bright grass-green. Each scale on the back is bordered with black and has a black median stripe on it. There is a black spot on each side of each ventral scale (these may be absent anteriorly, then appear as small dots, and get larger posteriorly); the subcaudals are marked

with black both on the sides and underneath. Head above and below lemon-yellow, boldly and extensively marked with intense velvety black above, these marks mostly taking the form of transverse bands. The anterior portion of the neck is greenish yellow beneath. Iris golden or yellowish brown. Inside of mouth red. Tongue red, with black tips and sometimes two transverse dark marks on it further up.

Young of Var. D: Yellowish green, with about 118 black transverse bands, each about twice as broad as the green interspaces; the scales forming the interspaces and those on the sides are edged with black. Tail extensively marked with black, forming both transverse bands and longitudinal lines. Ventrals with a small black spot on each side above the lateral keel. Head marked as in adults.

Hab. Southern India, Ceylon, Bengal, Assam, Burma, Southern China, Siam, Malay Peninsula, Sumatra, Nias, Sipora (Mentawei Islands), Java, Borneo (I obtained a specimen from Kudat), Celebes, Sulu Islands, Philippines.

182. CHRYSOPELEA CHRYSOCHLORA (Reinw.).

Chrysopelea chrysochlora, Blgr. Cat. Snakes, iii. p. 138.

Recorded from Penang and Singapore. In September 1897 I obtained a specimen in the foothills of Gunong Pulai, Johore. Length 739 mm.

Colour (in life). Above olive-green, the back ornamented by very distinct bright yellow narrow transverse bands, not extending on to the sides; these yellow bands are bordered in front and behind with black, and the broad interspaces are bright red. These yellow, black, and red markings are most distinct on the anterior quarter of the body, and get fainter further back, but they are distinguishable right to the tip of the tail. The lower surface (between the lateral keels) is pale olive-green. The lateral keels of the ventral scales are outlined in black; and the part of the ventral scales above the lateral keel is bright lemon-yellow, each scale narrowly outlined with black. Thus between the darker green upper parts and the paler green belly is a bright yellow stripe along each side, which is continued on to the tail, where it gradually disappears. The upper surface of the head is olive-brown, with a red chevron-like cross-band (with point forward) behind the eyes; behind this again there is a much smaller chevron pointing backward, and on the back of the head a cross-band, broad in the centre and narrowing to each side; these three red marks are outlined in black. There is a black line on either side of the head, running from below the nostril, through the lower part of the eye, to the angle of the mouth, dividing the dark upper parts of the head from the lemon-yellow lips and lower surface.

Hab. Burma, Malay Peninsula, Sumatra, Nias, Banka, Borneo, Natuna Islands.

Series Proteroglypha.

Subfamily Hydrophiinæ.

Sea-snakes abound in the Straits of Malacca, in the China Sea, and in the Gulf of Siam; those which frequent estuaries are caught from time to time in fishing-stakes, but we know very little of those which frequent the open sea. I find in my diary frequent references to seeing them; two such will suffice here:—"21.9.97. Off Borneo, approaching Labuan, in the afternoon from about 4 to 6 p.m. we saw many scores of sea-snakes. Every few minutes the steamer passed one, and sometimes there were two or three within a few yards of each other; most were from one to two feet long, the largest perhaps as much as four feet. Judging from the colours, they were several different species. The extreme brilliancy of the colouring of some was very beautiful and remarkable; some were almost entirely rich-golden yellow, others lemon-yellow; most had dark transverse bands of black or brown; some were green, banded alternately darker and lighter." "3.5.98. Gulf of Siam. During the afternoon saw six sea-snakes, all apparently of the same species; size small; colour yellowish olive. They did not seem aware of the steamer's approach till her bows were a few yards from them; then the snakes tried hard to swim away, wriggling on the surface, partly in and partly out of the water, but were of course quickly overtaken, and as soon as the spray from the steamer's fore-foot reached them they dived vertically downward."

183. Hydrus platurus (L.).

Hydrus bicolor, Cantor, p. 135 (also *pelamis*, Cantor, p. 136?).
Pelamis bicolor, Blanford, P. Z. S. 1881, p. 215.
Hydrus platurus, Blgr. Cat. Snakes, iii. p. 267.

Cantor obtained "a single individual taken in a fishing-stake off the coast of Province Wellesley," and it is recorded from Singapore by Blanford and by Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 10). The British Museum Catalogue mentions specimens from "Siam" and the "Gulf of Siam."

Hab. Obok, Red Sea (Blgr. A. M. N. H. April 1897, p. 468), Indian Ocean, Straits of Malacca, the Tropical and Subtropical Pacific from the Loo Choo Islands to Australia and New Zealand, and from the Malay Archipelago to Central America.

184. Hydrophis cærulescens (Shaw).

Hydrophis cærulescens, Blgr. Cat. Snakes, iii. p. 275.
Hab. Bombay Coast, Bay of Bengal, Straits of Malacca.

185. Hydrophis nigrocinctus Daud.

Hydrophis nigrocinctus, Blgr. Cat. Snakes, iii. p. 277.
Hab. Bay of Bengal and Straits of Malacca.

186. HYDROPHIS GRACILIS (Shaw).

Hydrophis gracilis, Blgr. Cat. Snakes, iii. p. 280.

Recorded from Singapore, for the first time, by Dr. Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 10).

Hab. Coasts of Persia, India, and Burma; Malay Archipelago.

187. HYDROPHIS CANTORIS Günth.

Hydrus gracilis, part., Cantor, p. 130.
Hydrophis cantoris, Blgr. Cat. Snakes, iii. p. 281, pl. xiv.

Hab. Bay of Bengal and Straits of Malacca.

188. HYDROPHIS FASCIATUS (Schn.).

Hydrophis atriceps, Günther, Rept. Brit. Ind. p. 371, pl. xxv. fig. I.
Hydrophis fasciatus, Blgr. Cat. Snakes, iii. p. 281.

The British Museum contains a Penang specimen (from Cantor), and two said to be from Siam.

Hab. From the coasts of India to China and New Guinea.

189. HYDROPHIS TORQUATUS Günther.

Hydrus nigrocinctus, Cantor, p. 128.
Hydrophis torquatus, Blgr. Cat. Snakes, iii. p. 283.

Cantor obtained five specimens during four years in the Straits of Malacca.

Hab. Bay of Bengal and Straits of Malacca.

190. HYDROPHIS OBSCURUS (Daud.).

Hydrophis obscurus, Blgr. Cat. Snakes, iii. p. 284.

I have seen a specimen, 807 mm. in length, from the Gulf of Siam.

Hab. Bay of Bengal, Malay Archipelago, Gulf of Siam.

191. DISTIRA STOKESII (Gray).

Distira stokesii, Blgr. Cat. Snakes, iii. p. 288 (skull fig. p. 286).

Hab. Mekran Coast, Indian Ocean, Straits of Malacca (Singapore), North coast of Australia.

192. DISTIRA ORNATA (Gray).

Distira ornata, Blgr. Cat. Snakes, iii. p. 290.

The British Museum Catalogue records a specimen from Siam.

Hab. From the mouth of the Persian Gulf and the coasts of India and Ceylon to New Guinea and North Australia.

193. DISTIRA BRUGMANSII (Boie).

Hydrus striatus, part., Cantor, p. 126.
Distira robusta, Blgr. Fauna Ind., Rept. p. 409.
Distira brugmansii, Blgr. Cat. Snakes, iii. p. 292.

Hab. Persian Gulf, coasts of India and Burma, Straits of Malacca (Penang), and the Malay Archipelago.

194. DISTIRA CYANOCINCTA (Daud.).

Hydrus striatus, part., Cantor, p. 126.
Distira cyanocincta, Blgr. Cat. Snakes, iii. p. 294.

Hab. From the Persian Gulf and the coasts of India to China, Japan, and Papuasia.

195. DISTIRA JERDONII (Gray).

Hydrus nigrocinctus, var., Cantor, p. 129, pl. xl. fig. 8.
Distira jerdonii, Blgr. Cat. Snakes, iii. p. 299.

This is apparently a very rare species. Cantor obtained "a single individual, captured in a fishing-stake off Pinang," during his four years in the Straits of Malacca, and it does not seem to have been observed again since his time.

Hab. Bay of Bengal, Straits of Malacca, Borneo.

196. ENHYDRIS HARDWICKII (Gray).

Hydrus pelamidoides, Cantor, p. 133.
Enhydris hardwickii, Blgr. Cat. Snakes, iii. p. 301.

Cantor obtained four specimens during four years in the Straits of Malacca. It is recorded from "Bangkok" (Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 10).

Hab. Bay of Bengal, Straits of Malacca, China Sea, and sea of the Malay Archipelago as far east as New Guinea.

197. ENHYDRINA VELAKADIEN (Boie).

Hydrus schistosus, Cantor, p. 132.
Enhydrina velakadien, Blgr. Cat. Snakes, iii. p. 302.

Siamese. "Ngu chai-tong."

Cantor writes of this species:—"Incredibly numerous in the Bay of Bengal, at Pinang and Singapore, far more so than any known terrestrial serpent. The fishing-nets are hardly ever worked but one or more are among the contents." The British Museum has a specimen from Siam presented by W. H. Newman, Esq., and there is one in the Siamese Museum from the Gulf of Siam, 933 mm. in total length.

Hab. From the Persian Gulf, along the coasts of India, Burma, Siam, the Malay Peninsula and Archipelago, to Papuasia.

198. AIPYSURUS EYDOUXI (Gray).

Aipysurus eydouxii, Blgr. Cat. Snakes, iii. p. 304.
Aipysurus eydouxi, S. Flower, P. Z. S. 1896, p. 893.

The occurrence of this species on the coast of the Malay Peninsula was doubtful, but we now know it to be found at Singapore, as I obtained a specimen caught on some flooded land near the Serangoon Road in 1896. Length about 500 mm.

Hab. Coasts of Singapore, Java, and the Philippines.

199. PLATURUS LATICAUDATUS (L.).

Platurus fischeri, Günth. Rept. Brit. Ind. p. 356, pl. xxv. fig. A.

Platurus laticaudatus, Blgr. Fauna Ind., Rept. p. 395 (head fig. p. 394); Blgr. Cat. Snakes, iii. p. 307.

The British Museum contains a specimen from Chantaboon, Siam.

Hab. Bay of Bengal, Gulf of Siam, Loo Choo Islands, New Guinea, and the Western South Pacific (Fiji, New Hebrides, Australia, and Tasmania).

200. PLATURUS COLUBRINUS (Schn.).

Laticauda scutata, Cantor, p. 125.

Platurus colubrinus, Blgr. Cat. Snakes, p. 308 (skull fig. p. 307).

Recorded from Penang and Singapore; Cantor obtained only three specimens in four years, so it is apparently not numerous.

Hab. Bay of Bengal, Engaño, Straits of Malacca, Malay Archipelago, and the Western South Pacific (Fiji, New Hebrides, Australia, and New Zealand).

Subfamily ELAPINÆ.

201. BUNGARUS FASCIATUS (Schn.).

Bungarus fasciatus, Blgr. Cat. Snakes, iii. p. 366.

Localities. This fine snake, coloured yellow and black in alternate rings, is popularly confounded with the harmless *Dipsadomorphus dendrophilus*, so may not be as numerous in the Malay countries as some suppose; it is known to occur in the following localities:—Penang (Cantor and Stoliczka), Province Wellesley (Cantor and Van Sommeren coll.), Kuala Lumpor (Selangor Museum), Malacca (Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 10), Johore (Kelsall, *vide* post.), and Singapore (Blanford). Two specimens supposed to have been caught in Bangkok are in the Siamese Museum; and the British Museum Catalogue mentions two specimens from Siam, presented by Sir R. Schomburgk and W. H. Newman, Esq.

H. J. Kelsall, J. S. B. Royal Asiatic Soc. no. 26, 1894, p. 12, when on the Batu Pahat Sembrong in Johore, "saw a fine specimen of the banded viper (*Bungarus fasciatus*) in a hole in the bank. On an attempt being made to kill it, it took to the water and by diving escaped."

Size. A specimen caught in Kuala Lumpor, Selangor, measured in total length 1270 mm. (or 4 feet 2 inches).

Hab. India, Assam, Burma, Southern China, Siam, Malay Peninsula, Sumatra, Java.

202. BUNGARUS CANDIDUS (L.).

Bungarus cæruleus, Blgr. Fauna Ind., Rept. p. 388.

Bungarus candidus, Cantor, p. 113; Blgr. Cat. Snakes, iii. p. 368 (skull fig. p. 365).

Localities. The Krait, supposed to be one of the most deadly of

poisonous snakes, is fortunately of very rare occurrence in the Malay Peninsula. Cantor obtained a specimen 857 mm. in length "killed by Captain Congalton near Keddah." On the 1st June, 1898, I obtained a specimen near Alor Star, Kedah, 775 mm. in length. Imagining it to be the harmless snake *Lycodon subcinctus*, I carried it in my hand upstairs to keep in my room, but fortunately noticed it was a Krait and killed it before it had bitten anyone. A few days later a servant came upstairs and placed on the table a snake he had come across in the garden and thought I might like: it was a live Cobra (*Naia tripudians*); in this case also luckily the snake had not bitten anyone.

Description (notes on). Alor Star specimen mentioned above: temporals 1+2; three lower labials in contact with the anterior chin-shields, which are larger than the posterior. Scales in 15 rows. Ventrals 220. Anal? Subcaudals single, 40 (tip broken), except the 24th and 25th, which are double.

Colour (in life). Above purplish black, with 28 double white cross-bands. Skin between scales whitish. Lips, chin, throat, and underneath of body pale yellow, immaculate. Underneath of tail purplish brown, with irregular pale yellow cross-bars.

Hab. India, Burma, Southern China, Formosa, Hainan, Indo-China, Lower Siam (Malay Peninsula), Java, Celebes.

203. BUNGARUS FLAVICEPS Reinh.

Bungarus flaviceps, Blgr. Cat. Snakes, iii. p. 371; S. Flower, P. Z. S. 1896, p. 894.

Hab. Tenasserim, Cochinchina, Malay Peninsula, Sumatra, Nias, Java, and Borneo.

204. NAIA TRIPUDIANS Merr.

Naia tripudians, Blgr. Cat. Snakes, iii. p. 380 (skull fig .p. 372); S. Flower, P. Z. S. 1896, p. 894.

Siamese. "Ngu how."

"Toodong slà" of the Malays of Kedah.

"Ular mata-ári" of the Malays, according to Cantor. Ular= snake; mata-ári=sun (lit. eye of the day).

Localities. The Cobra is apparently not so numerous in the Malay Peninsula as in parts of India and in Siam; the British Museum Catalogue records var. A.*a* from Penang, var. C.*b* from Siam and Kedah, and var. D from Penang and Singapore. Mr. Van Sommeren's collection contains a Cobra from Kuala Lumpor, Selangor, and three caught on Penang Hill; these are of small size, light brown in colour, and have no marks on the hood. I obtained a Cobra, in lalang grass, near Taiping, Perak, which does not agree with any of the described varieties. One caught near Alor Star, Kedah, belongs to var. C.*b*, as do also nine individuals observed by me from the neighbourhood of Bangkok, where Cobras frequently attain a large size, as the following table shows.

Description (notes on).

No.	Locality.	Ventrals.	Sub-caudals.	Neck-scales.	Body-scales.	Length.	Colour variety.	Remarks.
						mm.		
1.	Bangkok.	185	53	31	21	400	C.*b.*	1 præ- & 3 postoculars.
2.	„	186	?	29	21	1619	„	
3.	„	185	?	30	21	1683	„	
4.	„	178	55	?	21	1803	„	
5.	„	181	55	?	21	1830 (or 6 feet)	„	
6.	„ ♀	184	51	28	21	1830 (or 6 feet)	„	3 postoculars, temporals 2 + 3.
7.	Alor Star, Kedah.	183	56	28	21	432	„	
8.	Taiping, Perak.	171	?	27	19	1441	?	

Habits. A female killed in Bangkok on the 17th January, 1898, contained nineteen eggs, measuring, greater axis 53 mm., lesser axis 34 mm. The Siamese assured me they sometimes lose buffaloes through the Cobras which frequent the fields where the cattle graze, the bite of the snake being sufficiently poisonous to kill such large animals.

Colour (in life). Siamese Cobras.—Above varying from uniform olive-brown to deep black, with brownish head. Below grey or bluish black. Lips, chin, and throat bright yellow. "Hood" ornamented with (usually) a very well-defined bright yellow O, edged both inside and out with black. Under surface of "hood" yellow, with a black spot on each side. Behind the "hood" a yellow collar, broad beneath, and above mottled with brown or dividing into two very narrow lines, the anterior straight across the neck, the posterior chevron-shaped, pointing backward.

Perak Cobra.—Above uniform pale yellowish brown, no markings on "hood," which when expanded looks very yellow, owing to the pale yellow skin showing between the scales. Underneath the neck are a short median series of indistinct brownish spots, and three pairs of brownish spots. Remainder of lower surface pale yellow.

Hab. Southern Continental Asia from Transcaspia to China, Siam, and the Malay Peninsula, and the islands of Ceylon, Sumatra, Java, Flores, Ombaai, Borneo (I obtained Var. F at Kudat), Palawan, Philippines, Hainan.

205. NAIA BUNGARUS Schl.

Hamadryas ophiophagus, Cantor, p. 116.
Naia bungarus, Blgr. Cat. Snakes, iii. p. 386.
"Toodong sindok" of the Malays of Kedah.
"Ular teedong selar" of the Malays of Perak (according to L. Wray).

Localities. The Hamadryad is known to occur in the following places:—Hills of Penang, and Province Wellesley (Cantor); Larut, Perak (Perak Museum); Kuala Lumpor (Selangor Museum and Van Sommeren coll.); Singapore (Dennys and Ridley), Siam (Brit. Mus. Cat., two specimens presented by W. H. Newman, Esq.).

Size. Two skins of Hamadryads killed near Taiping, Perak, now in the possession of Lt.-Col. Froude Walker, C.M.G., measure respectively about 3760 and 4040 mm.; another specimen killed within four miles of Taiping, now in the Museum there, measures about 4500 mm.; and one in the Kuala Lumpor Museum, which was killed in the neighbourhood, is said to be 15 feet long (4572 mm.).

Hab. India, Burma, Southern China, Cochinchina, Siam, Malay Peninsula, Borneo, Celebes, Philippines.

206. CALLOPHIS GRACILIS Gray.

Elaps nigromaculatus, Cantor, p. 108, pl. xl. fig. 7.
Callophis gracilis, Blgr. Cat. Snakes, iii. p. 396.

I obtained one specimen in Singapore, October 1897.

Hab. Malay Peninsula and Sumatra.

207. CALLOPHIS MACULICEPS Günth.

Elaps melanurus (non Shaw), Cantor, p. 106, pl. xl. fig. 6.
Callophis maculiceps, Blgr. Cat. Snakes, iii. p. 397.

Hab. Burma, Cochinchina, Malay Peninsula (Prov. Wellesley).

208. DOLIOPHIS BIVIRGATUS (Boie).

Doliophis bivirgatus, Blgr. Cat. Snakes, iii. p. 400; S. Flower, P. Z. S. 1896, p. 895.

Localities. Var. A, *bivirgatus*: Penang (Brit. Mus.).

Var. B, *tetratænia*: Singapore (Brit. Mus.).

Var. C, *flaviceps*: Penang Hills (Cantor, Van Sommeren, & S.S.F.); Penang Plains (Van Sommeren); Kulim, Kedah (Mitchell); Taiping, Perak (Perak Museum); Larut Hills, 4500 feet elevation (Perak Museum); Selangor (Raffles Museum); Malacca (Cantor); Johore Bahru (Wilson); Gunong Pulai, Johore (S. S. F.); Singapore (Brit. Mus., Girard, & S. S. F.).

Colour (in life). Var. C: Head bright coral-red, slightly darker red on the occiput. Border of scales which enter eye black, making a narrow black ring round eye. Body, rich dark blue, highly iridescent, with on each side from neck to vent a line of light "Cambridge" blue, 2 scales wide; this light blue is separated from the red belly by a narrower line of dark blue. The lower surface is bright coral-red. The tail is bright coral-red, with a dorsal line of dark purplish blue, which commences the whole breadth of the tail and gets narrower towards the tip.

Size. A specimen I caught on Gunong Pulai, Johore, belonging to Var. C, measured 1708 mm. in total length; and one killed at

Sandakan, British North Borneo, given me by Mr. G. A. Altman of that town, belonging to var. B, measured 1811 mm. (or 5 feet 11 inches).

Hab. Burma, Cochinchina, Lower Siam, Malay Peninsula, Sumatra, Nias, Java, Borneo.

209. DOLIOPHIS INTESTINALIS (Laur.)

Doliophis intestinalis, Blgr. Cat. Snakes, iii. p. 401.

Of the Malay poisonous snakes this is perhaps the most frequently met with. I have come across it both in bright daylight and after dark, crawling slowly about; it is easily caught. What the effect of its poison on a man would be is, I believe, quite unknown; but from its small mouth and want of activity it can hardly be looked on as a dangerous species. Cantor found that fowls bitten by this snake died from within an hour and twenty minutes to upwards of three hours. "The serpents, which all had forcibly to be made to inflict the wounds, shortly afterwards expired, apparently from the violence to which they had been subjected."

Localities. Var. B, *annectens*: Pahang (Raffles Museum); Singapore (Ridley).

Var. C, *lineata*: Penang Hills (Cantor, Van Sommeren, & S.S.F.); Province Wellesley (S.S.F.); Taiping, Perak (Perak Museum); Pangkor, Dindings (Perak Museum); Kuala Lumpor, Selangor (S.S.F.); Malacca (Cantor); Singapore (Cantor & S.S.F.).

Var. D, *trilineatus*: Province Wellesley (S.S.F.).

Colour (in life). Var. C: Above rich reddish or purplish brown, with a narrow scarlet black-edged vertebral line; along each side a pale yellow line, above broadly edged with black, below edged with black spots on a somewhat vandyked dark-brown line. Underneath pale yellow, with black cross-bars generally about half the width of the yellow interspaces. Upper surface of head may be dull vermilion. Labials yellow, spotted with black. Under surface of tail bright coral-red, with three black cross-bars.

Size. The largest specimens I obtained in 1898 were only about 465 mm. in length.

Hab. Burma, Malay Peninsula, Sumatra, Nias, Java, Borneo, Celebes.

Family AMBLYCEPHALIDÆ.

210. HAPLOPELTURA BOA (Boie).

Dipsas boa, Cantor, p. 78, pl. xl. fig. 3.

Haplopeltura boa, Blgr. Cat. Snakes, iii. p. 439.

Cantor obtained two individuals from the Penang Hills, and recently Mr. A. G. B. van Sommeren found two at the same time in holes in the ground on Government Hill, Penang, at 2500 feet elevation. The snakes of this family are apparently very rare in he Straits Settlements; with the above exceptions, they are not

represented in any of the local museums, nor have I come across a single individual myself.

Hab. Malay Peninsula, Java, Borneo, Balabac, Palawan, Philippines, Moluccas.

211. AMBLYCEPHALUS LÆVIS Boie.

Amblycephalus lævis, Blgr. Cat. Snakes, iii. p. 441.

Hab. Malay Peninsula?; Java, Natuna Islands, Borneo.

212. AMBLYCEPHALUS MALACCANUS (Peters).

Amblycephalus malaccanus, Blgr. Cat. Snakes, iii. p. 442.

Hab. Malay Peninsula, Sumatra, Borneo.

213. AMBLYCEPHALUS MOELLENDORFFII (Boettg.).

Amblycephalus moellendorffii Blgr. Cat. Snakes, iii. p. 443.

The British Museum Catalogue records a specimen collected by M. Mouhot in the mountains of Laos.

Hab. Tenasserim, Siam, Cochinchina, Hainan, South China.

214. AMBLYCEPHALUS MARGARITOPHORUS (Jan).

Amblycephalus margaritophorus, Blgr. Cat. Snakes, iii. p. 445.

Hab. Siam.

Family VIPERIDÆ.

Subfamily VIPERINÆ.

215. VIPERA RUSSELLII (Shaw).

Vipera russellii, Blgr. Cat. Snakes, iii. p. 490.

Hab. "India, Ceylon, Burma, Siam; Sumatra and Java

Subfamily CROTALINÆ.

216. ANCISTRODON BLOMHOFFII (Boie).

Ancistrodon blomhoffii, Blgr. Cat. Snakes, iii. p. 525.

Hab. "Eastern Siberia, Mongolia, China, Japan, Siam."

N.B.—ANCISTRODON RHODOSTOMA (Boie).

Ancistrodon rhodostoma, Blgr. Cat. Snakes, iii. p. 527.

Hab. "Java; Siam (?)."

217. LACHESIS MONTICOLA (Günther).

Trimeresurus convictus, Stoliczka, J. A. S. B. 1870, p. 224, pl. xii. fig. 1.

Lachesis monticola, Blgr. Cat. Snakes, iii. p. 548.

Hab. Tibet, Himalayas, Assam, Burma, Malay Peninsula, Sumatra.

218. LACHESIS PURPUREOMACULATUS (Gray).

Lachesis purpureomaculatus, Blgr. Cat. Snakes, iii. p. 553 S. Flower, P. Z. S. 1896, p. 896.

Dr. Hanitsch records this snake from Singapore, Pulo Brani, and Pulo Samba (Rep. Raffles Mus. & Libr. 1897, p. 10).

Hab. Himalayas, Bengal, Assam, Burma, Andamans, Nicobars, Malay Peninsula, Sumatra.

219. LACHESIS GRAMINEUS (Shaw).

Lachesis gramineus, Blgr. Cat. Snakes, iii. p. 554; S. Flower, P. Z. S. 1896, p. 896.

Siamese. "Ngu kheeyo"="green snake."

"Ular daun" of the Malays (*apud* Cantor).

Localities. This Green Viper is the poisonous snake most often seen about Bangkok, where it is fairly numerous; about ten individuals were caught in my garden alone in about twelve months. The British Museum Catalogue mentions specimens obtained at Pachebone and in the Laos Mountains by M. Mouhot. It is apparently the commonest *Lachesis* in Penang (Cantor, Stoliczka, Van Sommeren, and S. S. F. [at 2000 ft. elevation]) and Province Wellesley (Stoliczka and S. S. F.), but at Singapore (from which place it is recorded by Cantor, Blanford, and Hanitsch) it is rare, its place being taken by *L. wagleri*.

Description (notes on).

No.	Locality.	Ventrals.	Sub-caudals.	Scales.	Length.	Upper head-scales, between supraoculars.	Inter-nasals.	Upper labials.
					mm.			
1.	Bangkok.	164	70	19	453	12	in contact	9+9
2.	"	162	54	21	540			
3.	"	165	69	21	470			
4.	"	166	60	21	317	9	in contact	10+10
5.	"	166	60	21	701 (2′ 3½″).	smooth, 9	" "	9+9
6.	"	166	72	21	325	" 9	" "	
7.	"	173	57	21	658	10	" "	10+12
8.	"	175	52	21	387	9	" "	9+10

Colour (in life). Bangkok specimen.—Above usually very bright grass-green, sometimes rich dark green with ill-defined blackish cross-bands. A light yellowish line is sometimes present along each side. Lower parts bright electric blue, pale bluish green, or bright grass-green. Upper part and end of tail dull red. Sides of head from below the eye to the corner of mouth blue. Labials bright grass-green or blue. Lower surface of head in some individuals white, with shades of cobalt-blue. The eye is very

conspicuous, with bright yellow iris and black vertically contracted pupil.

Habits. The Green Viper is a good climber, apparently diurnal and arboreal in its habits; it feeds on lizards (*Gehyra mutilata*) and (I believe) on small birds. We only once found a specimen in our house. Cantor says—"It is generally observed on trees, hanging down from the branches or concealed under the dense foliage; it preys on small birds and tree-frogs; but occasionally it descends to the ground in search of frogs and toads."

Hab. Himalayas, India, Burma, China, Formosa, Siam, Malay Peninsula, Sumatra, Java, Lombok, Flores, Sumba, Ombaai, and Timor.

220. LACHESIS SUMATRANUS (Raffles).

Lachesis sumatranus, Blgr. Cat. Snakes, iii. p. 557.

Hab. Malay Peninsula (Singapore), Sumatra, Nias, Sipora (Mentawei Islands), Borneo, Palawan.

221. LACHESIS WAGLERI (Boie).

Trigonocephalus sumatranus, Cantor, p. 121, pl. xl. fig. 9.
Lachesis wagleri, Blgr. Cat. Snakes, iii. p. 562.

"Ular kapak" of the Malays of the Peninsula (*apud* Cantor).
"Ular pùckuk" of the natives of Sumatra (*apud* Cantor).

Localities. Penang ("it generally occupies the lower parts of the hills, or the valleys, either on the ground or on trees; but Dr. Montgomerie in one instance observed it at an elevation of 2200 feet," *Cantor*): and in the Van Sommeren collection I noted several specimens of var. A from Penang Hills, one of var. D from Penang Hill, 2500 feet, and one from the low country of Penang.

Taiping, Perak (var. A, British Museum, per L. Wray, jun.).
Selangor (var. D, A. L. Butler).
Pahang (vars. A & D, Raffles Museum).
Malacca (var. D, British Museum, per D. F. A. Hervey).
Johore Bahru (var. A, S. S. F.; var. D, Dr. Wilson).
Singapore (vars. A & D, numerous specimens).

Varieties. The specimens of var. A that I have notes of are all of small size (*e. g.* 216, 230, 349 & 382 mm.), while those of var. D are of large size (*e. g.* 762 mm.). Unfortunately, I have not had the chance of looking at the fine series of this species in the British Museum, to see if they agree with the above remark. Is it possible that var. A represents the young and var. D the adult coloration of Malayan individuals of *Lachesis wagleri*?

Colour (in life). Johore specimens of var. A.—Above grass-green, paler green below; on each side of head, passing through eye, a line of rich red-brown, bordered above with orange; along each side of neck and body are about 34 vertical bars of rich red-brown, bordered *either* in front *or* behind with orange. Tail green, extensively marked with red and orange. Iris yellow, with horizontal brown line.

Hab. Malay Peninsula, Sumatra, Sirhassen and Great Natuna Islands, Borneo, Palawan, Celebes, Philippines.

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Fig. 1.

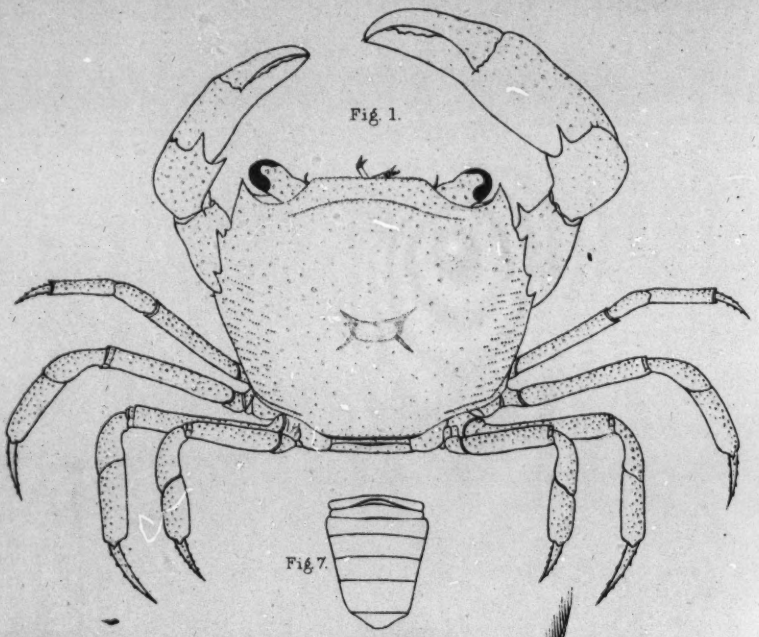


Fig. 7.

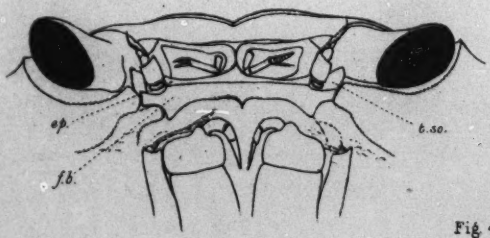


Fig. 2.

Fig. 4.

Fig. 5.

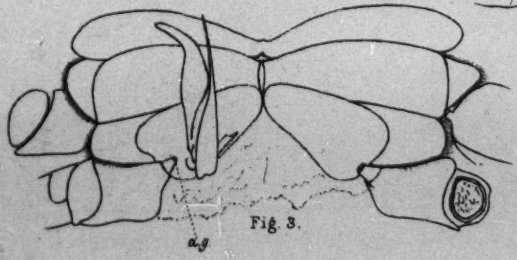


Fig. 3.

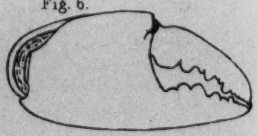


Fig. 6.

W. A. C. del.

J. T. Rennie Reid. Lith. Edin.r

LIMNOTHELPHUSA MACULATA.

EXPLANATION OF THE PLATES.

Plate XXXVI.

Trionyx subplanus, p. 619.

Plate XXXVII.

Fig. 1. *Typhlops albiceps*, p. 654. Upper and side views of head.
2. *T. floweri*, p. 654. Upper and side views of head.
3. *Cylindrophis rufus*, p. 656.

2. On a new Brachyurous Crustacean from Lake Tanganyika. By William A. Cunnington, A.R.C.S.[1]

[Received April 26, 1899.]

(Plate XXXVIII.)

The Crab described in this paper was obtained by Mr. J. E. S. Moore, of the Royal College of Science, from Lake Tanganyika during his visit in the summer of 1896. The specimens were taken in fairly deep water—never less than 60, and from that to 500 feet deep. I have had in all seven individuals to examine, of which three are adult males, two adult females, and the remaining two young ones. All these specimens, Mr. Moore informs me, were taken in Kituta Bay, at the southern end of the Lake, but he has also seen these Crabs near Kinyamkolo, also in the south, and Sumbu, some 100 miles up the western coast. They are often found clinging to *Neothauma*-shells and other objects, and are very active in habit.

Their deep-water habitat is at first sight misleading; but a careful examination shows that from the presence of a post-frontal crest, and from the nature of the external maxillipeds, chelipeds, and ambulatory legs, their characters are distinctly those of the group of the Thelphusidæ, in which, in consequence, they must be placed, although at any rate the majority of its members are mainly terrestrial in habit.

The differences which Mr. Moore's specimens exhibit, however, from any hitherto described form, are sufficiently great, I think, to warrant the institution of a new genus for their reception. I propose the name *Limnothelphusa maculata* for them, as suggesting, in the first place, their habitat, and in the second their characteristic spotted appearance.

This being at present the only known form of its kind, it is not easy to decide which of its characters denote a generic distinction, and which a merely specific. Following, however, as far as

[1] From the Biological Laboratory, R. Coll. Sci. Lond. Communicated by Prof. G. B. Howes, F.Z.S.

possible the method adopted for the distinction of genera and species in its nearest allies, it may be thus diagnosed:—

LIMNOTHELPHUSA, gen. nov.

Carapace moderately convex, antero-lateral margins arcuated and armed with spines. Front somewhat deflexed, nearly straight, and more than one-third the width of the carapace. Orbits large, with prominent inner subocular tooth. Eyes large, with peduncles short and stout. Second joint of antenna simple, not distorted by deflexed front. Merus of external maxillipeds roughly quadrilateral, the carpus being attached towards its inner front angle. Ambulatory legs considerably compressed.

LIMNOTHELPHUSA MACULATA, sp. nov. (Plate XXXVIII.)

Regions and sutures on carapace moderately marked. Postero-lateral regions exhibiting an irregular series of small, slightly oblique and granular ridges. Post-frontal crest distinct, with median notch and partial lateral interruptions, but not extending to margins. Antero-lateral margins shorter than postero-lateral, armed with 2–3 spines, in addition to that at the outer angle of the orbit. Second joint of antenna extending to under border of front, and bearing a short flagellum. Chelipeds in the male unequal, subequal in the female; merus rather short, trigonous, with spine on inner margin; carpus with two spines on inner margin. Ambulatory legs rather long and slender. Colour (in spirit) light yellowish brown, with dark brown or reddish spots.

Dimensions as follows:—

	mm.
Adult male (largest specimen):	
Length of carapace	12
Breadth of carapace	15·4
Length of larger cheliped ..... about	21·7
Length of second ambulatory leg, about	21
Adult female:	
Length of carapace	11·5
Breadth of carapace	13·6
Length of cheliped ..... about	12·8
Length of second ambulatory leg, about	14·1

While the carapace is here, as throughout the Thelphusine group, broader than long, that condition is somewhat less pronounced, giving an effect of greater squareness. The great relative breadth of the front and size of the orbits are features also specially noticeable, even at first sight. The prominent and distinct condition of the subocular tooth (fig. 2, *t.so.*) seems characteristic, while a crenulated subocular margin forms a further point of difference from other members of the group. The antennules, with their large basal joints, are situated in the normal transverse position, and the antennæ occupy the interior orbital hiatus. The external maxillipeds, while Thelphusine in character,

and having well-developed palp-bearing exopodites, are, as will be seen from fig. 4, certainly distinctive. The respiratory apertures, often so noticeable in its allies, are in *Limnothelphusa* very inconspicuous. In fig. 6 the rather finely dentated condition of the chelipeds may be seen, as also the fact that they end in sharp points tipped with a somewhat transparent yellowish cap of dense chitin. The styliform dactyli of the ambulatory legs, too, are furnished with longitudinal rows of spinules (fig. 5) similarly tipped. That the male genital apertures (*a.g.* fig. 3) are situated on papillæ on the basal joints of the last pair of ambulatory legs may be easily made out on removal of the abdomen. The abdomen itself is in both sexes distinctly seven-jointed (fig. 7), and in the normal manner covers at its base the whole width of the sternum. As is also the case among its nearest allies, the penultimate segment of the abdomen is the longest. Nine pairs of gills of the perfectly normal type are seen on dissection.

One feature in which the specimens exhibit marked individual variation is the development of spines on the antero-lateral margins of the carapace. The presence of three spines in all is, perhaps, the most common condition; but additional more or less distinct spines may exist between these prominent ones, the culminating condition being that shown on the left side in the largest male specimen (fig. 1). This individual is quite asymmetrical as regards these spines, a well-developed fourth and a suggestion of a fifth occurring on the left border, while the right edge shows only a partially developed fourth. This would suggest that a process either of multiplication or reduction of the lateral spines may be going on here, since the largest specimen shows what would be an extreme condition in either case.

A further individual difference was noticeable between this specimen and most of the others. On examination with a hand-lens, the majority gave the appearance of being strongly haired, particularly in the anterior and lateral regions of both dorsal and ventral faces of the carapace. By removing a small quantity of this apparent "hair," however, and examining it under higher powers, its true nature could at once be seen. Each "hair" consisted of a more or less perfect tubular structure, tapering towards the point of attachment, and containing, apparently, a protoplasmic mass. By treatment on a microscope-slide with a mixture of glycerine and picro-carmine, further internal structure, in the shape of a long and spirally-coiled nucleus, could be made out, this leading to the conclusion that the supposed "hairs" are really an incrustation of some form of tubicolous protozoan, and the presence of various diatoms in certain of the tubes confirms the supposition. More than this it is impossible to record, since the Crabs were not preserved with a view to minute histological investigation. One further interesting fact, however, is that encrusting these tubes in turn there may be clearly observed specimens of a Vorticellid or some closely-allied Infusorian. The fact that the large specimen (fig. 1) was not covered by these

foreign growths is easily accounted for. It is, I understand, the largest individual that Mr. Moore has ever seen, and from its soft texture it had clearly recently undergone ecdysis, becoming for the time free from encrusting organisms.

Affinities.—That this Crab finds its nearest allies among the freshwater group of the Thelphusidæ there can, I think, be little doubt. Of the three sections into which Ortmann has subdivided the group [1], the Pseudothelphusinæ and the Trichodactylinæ may be at once dismissed, as differing most markedly in the character of their external maxillipeds. This excludes the New World forms, leaving only, in the section Thelphusinæ, those typical of the Old World, though occurring also in Australia. The principal points of resemblance to, and difference from, the members of this group, which this Tanganyikan crab presents, may be conveniently stated in tabular form.

Points of resemblance to the Thelphusinæ [2]:—

(1) Presence of distinct post-frontal crest.
(2) Conditions of sutures on carapace.
(3) Form of external maxillipeds.
(4) Character of chelipeds.
(5) Spinuliferous condition of ambulatory dactyli.
(6) Normal seven-jointed nature of abdomen.

Points of difference from the Thelphusinæ:—

(1) Length of carapace more nearly equal to the breadth.
(2) Carapace considerably less vaulted.
(3) Antero-lateral margins relatively longer.
(4) Greater breadth and less deflection of front, with larger size of orbits and eyes.
(5) Second joint of antenna not distorted by deflexed front.
(6) Spotted nature of test.

Two genera only—*Parathelphusa* and *Thelphusa*—are included by Ortmann under the heading Thelphusinæ. Of these, *Parathelphusa* was originally supposed to be typically Indo-Malayan in distribution, but in 1887 A. Milne-Edwards [3] included under this heading several forms originally described as *Thelphusa* from the African continent. The genus *Thelphusa* is widely distributed over all parts of the Old World. By the kindness of Prof. Jeffrey Bell, M.A., I have been permitted to examine the large number of specimens belonging to these two genera in the collection of the British Museum. Among them there are no forms which would seem to be closely allied to *Limnothelphusa*, but so far as general appearance goes the specimens of *Parathelphusa* certainly agree most nearly. The latter have a carapace more elongated in

[1] Zool. Jahrb. (Abth. f. Syst.) Bd. vii. 1894, p. 487.
[2] The term is here used as instituted by Ortmann, though in his scheme of classification he does not refer to the genera *Hydrothelphusa* and *Platythelphusa*.
[3] Ann. Sci. Nat. vii., Zool. t. 4.

proportion, have larger spine-bearing antero-lateral margins, and are considerably more flattened. The front, too, though deflexed[1], is less so than in *Thelphusa*. On the other hand, however, in several of the described species the abdomen of the male is of the so-called "hour-glass" shape[2], while in all one spine only seems to be developed on the carpal joints of the chelipeds, and the second antennal joint is distorted in the common manner. The condition of the chelipeds is, however, in some species of *Thelphusa* strictly comparable with that of *Limnothelphusa*, so that in this respect we may consider the new form as occupying a somewhat intermediate position between these two old-established genera.

Two other little-known genera, however, *Hydrothelphusa* and *Platythelphusa*, must also, I suppose, be included in the group, though they are not mentioned by Ortmann. Of these, the former, from the streams of Madagascar, was first described in 1872[3] by A. Milne-Edwards. The description, however, was very brief, and though he has since[4] given a further account, as well as a figure of the dorsal aspect, our information is still unfortunately very incomplete. The front here, instead of being deflexed, is said to be almost horizontal, while the carapace is considerably flattened and nearly quadrilateral. Only a single tooth, however, is present on the antero-lateral margin, in addition to that at the outer angle of the orbit. With this the description of *Platythelphusa*[4], which actually comes from Lake Tanganyika, agrees in the main, but the antero-lateral margins are, in contradistinction, multi-dentate. Several figures of this form are given, but they are not, unfortunately, all one could wish. The figure of the antennæ suggests that we are dealing with a simple undistorted condition of the joints, such as I have seen nowhere else but in *Limnothelphusa*, but the right and left antennæ do not even agree one with another, according to the drawing. The fourth pair of walking-legs presents a peculiarity in being rather short, while the terminal joints are somewhat flattened and expanded, presumably for swimming purposes. The male of this form is unknown, so that it is to be hoped that Mr. Moore, during his present expedition to Tanganyika, will obtain further material, and so aid in clearing up this unsatisfactory state of our knowledge. Of the mode of life of either of these forms little or nothing can be learnt from the paper, which fact renders it still more difficult

[1] Milne-Edwards's description of the genus *Parathelphusa* (see Ann. Sci. Nat. iii., Zool. t. 20) is exceedingly brief, and as regards the deflection of the front certainly misleading. Using this definition, one might readily conclude that *Limnothelphusa* comes under it, though an actual comparison shows that the resemblance is by no means exact.

[2] Would it not be more satisfactory to keep these forms separate by constituting two new genera or sub-genera, this extremely prominent difference in shape of the male abdomen being made the basis of separation, as indeed has been done by Wood-Mason in his note on the genus (see Ann. & Mag. Nat. Hist. 1876, p. 122)?

[3] Ann. Sci. Nat. v., Zool. t. 15.

[4] Ann. Sci. Nat. vii., Zool. t. 4.

to effect a comparison with the other known types. From this unfortunate lack of information then, though it is difficult to determine the exact relations which these two genera should bear to those more fully known, there can, I think, be no doubt that both are wholly distinct from *Limnothelphusa*. Several features go to prove this: among them the feeble development of the post-frontal crest in both *Hydrothelphusa* and *Platythelphusa*; but perhaps the most conspicuous difference is the greater breadth of the front and larger size of the orbits and eyes in *Limnothelphusa*. In the existence of but one marginal tooth, in association with an almost horizontal condition of the front, we have in *Hydrothelphusa* a rather anomalous feature—a combination, as we shall have reason to see, of a specialized with a primitive character. Thus, while in respect to the condition of the front this form would appear to be closely allied to *Platythelphusa* and *Limnothelphusa*, as regards the nature of the antero-lateral margins, its affinities are rather with the genus *Thelphusa* itself.

Platythelphusa, in the possession of a little deflexed front, of perhaps an undistorted antenna, and of a multi-dentate margin to the carapace, stands clearly related to the only other form which combines these primitive characteristics—this new genus *Limnothelphusa*. More than this, in the present state of our knowledge, it is impossible to say, and which of the two last-mentioned genera may be fairly considered the more primitive further information alone will enable us to judge.

Of the manner in which this form attained its present distribution in Lake Tanganyika there are two possible views. Either from a land Thelphusan it has become converted gradually into a wholly aquatic type, or it may have entered the lake more or less directly from the sea, in those early times when, as has been suggested [1], the connection between them was far more close than at present. It is generally accepted that the Land-Crabs have descended from ancestors with a littoral habit, so that there would be no direct objection to the supposition that this creature has merely retained its primitive aquatic character, rather than regained it after adaptation to a terrestrial mode of existence. We can only come to a conclusion on this head by estimating how far the general structure of the animal suggests simplicity on the one hand, or, on the other, specialization. The arched or vaulted condition of the branchial regions of the carapace in *Thelphusa* is evidently a specialization in connection with aerial respiration. That such prominent vaulting does not here exist is not surprising, but though it is perhaps conceivable that this character, once attained, might be lost again on change of environment, it is, I think, more probable that such a condition was never reached by *Limnothelphusa*. Again, as regards the less prominent deflection of the front in the latter, the condition appears rather primitive than secondarily acquired; while the simple nature of the second antennal joint, as compared with that of *Thelphusa*, which so

[1] Q. J. M. S. vol. xli. p. 303.

much suggests a distortion produced by the frontal downgrowth, also supports this view. The greater number of spines occurring on the antero-lateral margins is a further feature, capable, however, of two possible interpretations. The carapace in but few species of *Thelphusa* bears more than one, and that a less prominent spine. If, then, we are dealing with a multiplication of marginal spines, we have an indication of greater specialization than that met with in *Thelphusa*, an indication contrary to the tendency of the other evidence. The other possible explanation, then, that a reduction towards the extreme condition of *Thelphusa* is in progress, would seem far more probable; and it is a noticeable fact that the marine and littoral Crabs, from which we may suppose this form has been derived by comparatively slight modifications, are far more spinous than any of the modern terrestrial or fluviatile forms. Thus, while *Platythelphusa* and *Limnothelphusa* would appear to be the most primitive of these Old World genera, *Parathelphusa*, in the less pronounced arching of the carapace and the more numerous lateral spines, would come as intermediate between them and the most specialized condition of *Thelphusa*.

On the causes which have contributed to the present-day distribution of these genera, a word or two may be said. It is no very recent conception that Madagascar and, through this island, the south of Africa itself, was perhaps at some remote period connected in a tolerably close manner with India. The present fauna of Madagascar, which shows marked Oriental affinities, bears this out; and from considerations of geological facts, particularly as regards the possession of a common flora in Carboniferous times, Dr. Blanford [1], following Suess and Neumayr, is inclined to regard the idea of a great continent, embracing Australia, India, and South Africa, as by no means improbable. The evidence for such a land-connection is not confined to beds of quite such ancient date, however, for both in Jurassic and Cretaceous times the fauna of the two areas is distinctly suggestive of this same continuity. If, then, we may imagine the ancestral *Thelphusa* as living on the shores of this early continent, in which the present Lake Tanganyika was represented as a narrow bay or fiord, it is not unreasonable to suppose that while *Limnothelphusa*, and perhaps *Platythelphusa*, staying in the lake, retained most nearly the ancestral characters, *Hydrothelphusa* and *Parathelphusa* [2], still largely aquatic in habit, would resemble them more nearly than *Thelphusa*, many species of which spend most of their time upon land.

It is of course difficult to tell how far any one character, or even collections of characters, may be primitive or adaptive, or again, whether an intermediate stage of greater specialization might not be attained and lost again on change of surroundings. On the whole, however, I conclude that this Crab presents rather lowly characters in the group to which it belongs.

[1] Anniversary Address to the Geological Society, 1890.
[2] Wood-Mason, *loc. cit.* p. 122.

EXPLANATION OF PLATE XXXVIII.

Fig. 1. *Limnothelphusa maculata*, gen. et sp. nov. (p. 698). Adult male, general view from above. ×2½ about.
2. Ventral view of the anterior portion, to show the relations of buccal frame, epistome, antennules, and antennæ.
3. Ventral view of posterior portion of thorax, abdomen removed, showing abdominal appendages and male genital papillæ.
4. External maxilliped.
5. Dactylus of walking-leg, to show the nature of the spinules.
6. Terminal portion of cheliped, showing nature of dentation.
7. Male abdomen, primitive dorsal view.

Figures 2–7 considerably enlarged.

Reference Letters.

a.g. Genital aperture. *ep.* Epistome.
f.b. Buccal frame. *t.so.* Sub-ocular tooth.

3. On two Species of Macrurous Crustaceans from Lake Tanganyika. By W. T. Calman, B.Sc., University College, Dundee.[1]

[Received April 29, 1899.]

(Plates XXXIX. & XL.)

The Crustaceans collected in Lake Tanganyika by Mr. J. E. S. Moore and placed in my hands for examination comprise specimens of two species of Prawns, one forming the type of a new genus allied to *Caridina*, the other being a probably new species of *Palæmon*.

Sub-order MACRURA.

Tribe Caridea.

Family Atyidæ.

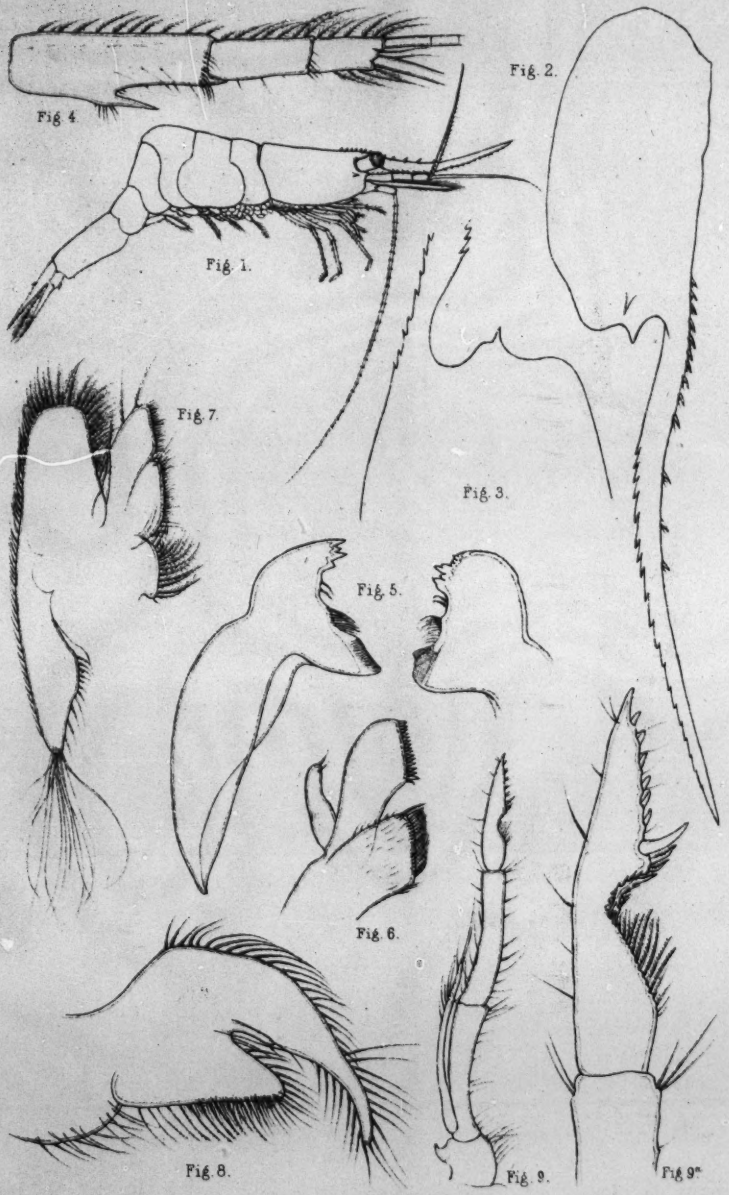
Limnocaridina, gen. nov.

Rostrum long, compressed, serrated. Carapace with a hepatic spine. Peræopods without exopods. Carpal joint of first pair slightly excavated distally, that of second pair not excavated. No epipods on any of the thoracic appendages. Gills four in number on each side, corresponding to the first four pairs of peræopods.

Limnocaridina tanganyikæ, sp. n. (Plates XXXIX. & XL. figs. 1–2, 4–19).

Description.—The rostrum (Pl. XXXIX. figs. 1–2) is very long and slender, gently recurved, varying from about 1⅓ to twice the length of the carapace, and extending beyond the antennal scale by ⅓ to nearly ½ its length. There are from 12–15 teeth on its

[1] Communicated by Prof. G. B. Howes, F.Z.S.



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J.T.Rennie Reid, Lith. Edin.

Figs. 1, 2, 4-9, LIMNOCARIDINA TANGANYIKÆ.
Fig. 3, CARIDINA WYCKII.

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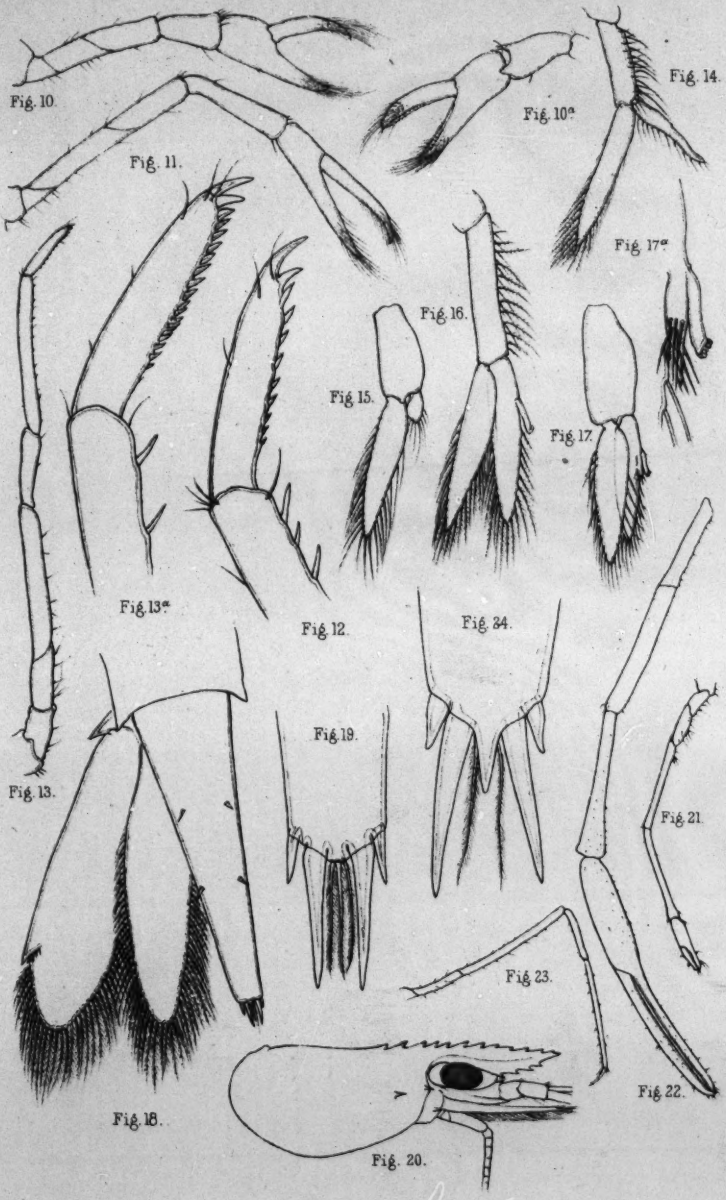

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J. T. Rennie Reid, Lith. Edin.r

Figs. 10-19, LIMNOCARIDINA TANGANYIKÆ.
Figs. 20-24, PALÆMON MOOREI.

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upper edge, three (rarely two) of which are behind the orbit. The teeth become more widely spaced distally, and the last one is generally separated by rather less than half the length of the rostrum from the simple, sharply pointed tip. The lower margin of the rostrum bears from 10–20 teeth, which extend quite to the tip. Below the orbit the anterior margin of the carapace is produced into a triangular tooth, but there is no "antennal" spine such as is present in most species of *Caridina*, e.g. in *C. wyckii* (Pl. XXXIX. fig. 3.). A little way back on the side of the carapace, and below the level of the sub-orbital tooth, there is a well-marked "hepatic" spine. The lower anterior corner of the carapace is evenly rounded, and there is no pterygostomial spine.

The peduncle of the antennules (Pl. XXXIX. fig. 4) falls short of the distal tooth on the outer margin of the antennal scale. The first joint is about equal in length to the two succeeding joints together. The basal spine is small and slender, its tip falling short of the distal end of the joint by $\frac{1}{4}$ the length of the joint. The short spine on the distal end of the first joint reaches to about $\frac{1}{4}$ the length of the succeeding joint. The ocular peduncle is rather shorter than the first joint of the peduncle of the antennule.

The mandibles (Pl. XXXIX. fig. 5) are somewhat dissimilar on the two sides. The cutting-edge is separated from the molar process by a shallow emargination, within which are set two stout setæ (in *C. wyckii* there is a row of about ten), followed at a little distance by a thick brush of finer setæ just in front of the molar process.

The first maxillæ (Pl. XXXIX. fig. 6) differ from those of *Caridina*, and such allied genera as *Atya* and *Atyaëphyra*, in the smaller size of the two inner lobes, the inner edges of which are much shorter, while the lobe which in these genera represents the exopod is here absent.

The second maxillæ (Pl. XXXIX. fig. 7) also depart somewhat from the type characteristic of the *Atyidæ*. In the other members of the family the middle lobe of the endognath (the proximal division of the *lacinia externa* in Boas's nomenclature) is very much expanded, overlapping both the other lobes and presenting a very long, straight, inner edge. In the present form this lobe is much smaller, its inner edge being hardly longer than that of the distal lobe, which it does not overlap. The proximal lobe, as in the other *Atyidæ*, is large and is overlapped for a short distance by the middle lobe. The scaphognathite is truncated anteriorly and produced to a point posteriorly, where it bears, as usual in this family, a tuft of very long slender setæ, hooked at the tip but not presenting the curious swelling and tooth near the base which characterize these setæ in *C. wyckii*.

In the first maxilliped (Pl. XXXIX. fig. 8) the exopod tapers gradually from the base with hardly an indication of the external lobe (marked *a* by Boas) present in *Caridina* as in most *Eukyphota*. The epipod, rudimentary in *Caridina*, seems to be quite absent.

The third maxillipeds (Pl. XXXIX. fig. 9) extend forward as

far as the end of the first joint of the peduncle of the antennules. There is on the outer surface of the coxal joint a conical curved papilla similar to, but smaller than, the papilla to which the epipod of this appendage, here absent, is attached in *C. wyckii*. The exopod exceeds in length the joint from which it springs. The terminal joint is shorter than the penultimate joint, and presents a remarkable structure (fig. 9*a*). About the middle of its length there is a deep excavation of the inner side, a little beyond which distally stands a stout curved spine; a double row of strong toothed spines smaller than the preceding and gradually diminishing in size, fringe the distal margin of the notch; the oblique posterior or proximal margin is fringed with feathered or pectinate setæ. Beyond the notch, the inner margin of the joint bears a series of 6–7 short spines leading up to the pointed apex of the limb. I am not aware that an arrangement similar to this is found in other *Atyidæ*. In *C. wyckii* there is only a very slight concavity of the inner margin of the joint, clothed with numerous spines and setæ.

The first pair of peræopods (Pl. XL. figs. 10, 10*a*) do not reach to the terminal joint of the third maxillipeds. The ischium and merus are short and subequal. The carpus is conical in shape, rather more than one-half as broad as long, about equal in length to the merus, and slightly longer than the palmar portion of the hand; it is slightly excavated distally on the inner side (fig. 10 *a*). The hand is long and narrow, the breadth being about one-third of the length. The fingers are slender, longer than the palm, spoon-shaped, but acutely pointed as seen from the side, instead of truncate as in *C. wyckii*. The opposed margins bear series of small stout spinules increasing in size towards the tip, but there is no strong terminal hook as in *C. wyckii*. The brushes of setæ borne by the fingers are very scanty compared with those of *C. wyckii*.

The second peræopods (Pl. XL. fig. 11) reach forward as far as the tip of the third maxillipeds. The ischium is a little longer than the merus and about equal to the carpus. The latter is cylindrical and only slightly wider distally. The hand is longer than the carpus by one-third the length of the latter, and its breadth is less than one-quarter of its length. The fingers are very long and slender, about twice as long as the palm, sharply pointed, and with scanty terminal brushes.

The third pair of peræopods extend beyond the third maxillipeds when turned forward, and the last pair fall short of them. The dactylus is one-third to two-fifths the length of the propodus. The dactylus of the last pair (Pl. XL. fig. 13*a*) is similar to the preceding two pairs, having only a slightly larger number of spines on its inner margin, the numbers being from 11 to 15 in the case of the third and fourth peræopods, and from 16 to 19 in the last pair. In *Caridina* the dactylus of the last peræopods is longer and bears a much more numerous series of spines than do those of the preceding two pairs. In a specimen of *C. wyckii*, for example, the dactyli of the third and fourth pairs bore 7 and 8 spines

respectively, while the dactylus of the fifth pair was half as long again and had a row of 39 spines.

In the female, the first pair of pleopods (Pl. XL. fig. 14) have the endopod rather slender, pointed, and more than half the length of the exopod. In the male (Pl. XL. fig. 15), the endopod is a short ovate leaflet about one-quarter the length of the exopod. In nearly all the specimens of both sexes the first pair of pleopods are turned forward, with the exopod lying above and external to the bases of the posterior peræopods. According to F. Müller (Kosmos, ix. 1881, p. 121), this is the position taken by these appendages in the living *Atyoida*, and he states that they serve to protect the entrance to the branchial chamber, the fringe of marginal setæ acting as a sieve to exclude mud, &c.

In the second pleopods of the male (Pl. XL. figs. 17, 17*a*), the *appendix masculina* is a little shorter than the *appendix interna*, and bears a number of stout spines.

The telson (Pl. XL. fig. 18), is about as long as the inner plates of the uropods, with straight sides, tapering to the obtusely pointed tip which bears four spines, two short external and two longer internal, between which latter spring three plumose setæ. On the dorsal surface of the telson are two pairs of spinules. In *C. wyckii* the tip of the telson bears eight spines, and the dorsal surface three pairs of spinules.

The gills are four in number on either side, three pleurobranchs, corresponding to the second, third, and fourth peræopods, and one which I believe to be a pleurobranch (though it is difficult to determine the precise point of insertion) above the first peræopod. There are no epipods on the maxillipeds or peræopods, unless we regard as a rudimentary epipod the small papilla at the base of the third maxilliped described above. In tabular form the arrangement is:—

	mxp.^{2}	mxp.^{3}	per.^{1}	per.^{2}	per.^{3}	per.^{4}	per.^{5}	
Pleurobranchiæ...	—	—	1	1	1	1	—	4
Podobranchiæ ...	—	—	—	—	—	—	—	—
Arthrobranchiæ...	—	—	—	—	—	—	—	—
Total	.....	.....	.....	.....	.....	.....	.....	4

The statements of various authors as to the branchial formulæ of the genera of *Atyidæ* are somewhat conflicting, but all agree in giving a larger number of gills and a complete series of epipods as far as the fourth peræopods.*

* F. Müller states (*l. c.* p. 121) that in *Atyoida potimirim* the last two pairs of legs are without epipods.

In *C. wyckii* * and *C. typus* I find the following arrangement:—

	mxp.[2]	mxp.[3]	per[1].	per.[2]	per.[3]	per.[4]	per.[5]
Pleurobranchiæ.....	—	—	1	1	1	1	1
Arthrobranchiæ.....	—	2	1	—	—	—	—
Podobranchiæ	1	ep.	ep.	ep.	ep.	ep.	—

This agrees with the formula for *Atya*. Claus states that *Troglocaris* lacks the arthrobranch of the first peræopod. According to Boas, *Atyaëphyra desmarestii* has no arthrobranch on the first peræopod, and only one on the third maxilliped.

The males are usually somewhat smaller than the females, and have as usual the pleural plates of the abdomen less deep. In the female the two flagella of the antennule are of about equal length, and about twice as long as the peduncle, the outer flagellum being slightly thickened for about two-thirds of its length. In the male both flagella are much elongated, the outer being longer than the inner, and in uninjured specimens measuring more than four times the length of the peduncle, or about one-half the length of the body. The thickened basal part is more distinct than in the female. I have not observed any sexual differences in the armature of the walking-legs or of the maxillipeds, nor in the shape of the anterior margin of the carapace, such as are described by Müller in *Atyoida*.

The eggs carried by the females are ovoid in form, measuring about ·18 × ·27 mm.

Total length of largest specimen (♀), 23 mm.

Many specimens of this form were collected in shallow water.

Comparing the new form with the other genera of *Atyidæ* as revised by Ortmann (Proc. Acad. Nat. Sc. Philad. 1894, p. 397), we find that (like all the other higher *Atyidæ*) it differs from *Xiphocaris*, *Troglocaris*, and *Atyaëphyra* in the absence of exopods from all the peræopods. It resembles *Caridina* and differs from *Atya* and *Atyoida* in the fact that the carpus of the second peræopods

* The formula given by Hickson is incomplete (Ann. Mag. Nat. Hist. (6) ii. 1888, p. 361). Although the number of the epipods (mastigobranchiæ) is given correctly, these organs appear to have escaped his notice, for he figures as "mastigobranchiæ" the long coxal setæ of the peræopods. The true epipods are of a shape similar to those of many other *Caridea*, and like those figured by Joly in *Atyaëphyra* and by Müller in *Atyoida*, consisting of a short curved stem directed backward and terminated by a strong hook which grasps firmly the coxal setæ of the next succeeding peræopod.

† It is possible that one of these should be regarded as a pleurobranch. In *Atya* the corresponding gills are certainly arthrobranchs, as stated by Pocock (A. M. N. H. (6) iii. 1889, p. 15). Claus, who does not attach much morphological importance to the place of insertion, assigns these two gills to his series *b* & *c* respectively (Neue Beitr. z. Morph. d. Crust., Arb. Zool. Inst. Wien, vi. 1884, p. 57).

is not excavated distally. It further agrees with the majority of the species of *Caridina* in the compressed and serrated rostrum, which, however, is much longer than in any species except *C. gracilirostris* de Man. It appears to differ from all except *C. singhalensis* Ortm. and *C. brevirostris* Stm. in the absence of a distinct antennal spine on the front of the carapace, and it certainly differs from all the species of *Caridina*, and I believe from all the other *Atyidæ*, in the possession of a hepatic spine. The differences noted above in the shape of the first maxilla, the first maxilliped, and especially of the second maxilla, may possibly be of generic importance, as may also the fact that the dactylus of the last peræopods does not differ markedly from those of the preceding pairs.

The most striking and important character, however, is the reduction of the branchial system. This has not been examined (so far as I know) in *Xiphocaris*, but the closely-allied *Troglocaris* possesses eight gills (Claus), *Atyaëphyra*, seven (Boas), *Atya scabra* and *Caridina wyckii* and *typus*, nine; while there is no reason to anticipate any very great divergence in the closely-allied *Atyoida* or among the numerous species of *Caridina* which have not been examined in this respect. Further, all the forms hitherto examined possess (with a possible exception, as above noted, in the case of *Atyoida*) a complete series of epipods on the thoracic appendages. In the present form there are only four gills and no epipods at all.

While there appears to be room for a further revision of the *Atyidæ* based on a more complete examination of their morphology than that recently given by Ortmann, it seems plain that the form now described stands sufficiently far apart from the other members of the family to require the creation of a new genus for its reception.

Family Palæmonidæ.

Palæmon moorei, sp. n. (Plate XL. figs. 20-24.)

Description.—Rostrum (Pl. XL. fig. 20) horizontal, a little longer than the peduncle of the antennules and equal to or shorter than the antennal scale. The nearly straight upper edge bears 11–13 teeth, of which three are on the carapace, the fourth being just over or a little in front of the posterior margin of the orbit. The distal tooth is close to the tip. The lower margin bears 3–4 teeth, the first being above the end of the first joint of the antennular peduncle. The usual antennal and hepatic spines are present on the carapace, the surface of which is elsewhere smooth. The third maxillipeds extend beyond the peduncle of the antennæ by the length of their last joint. The first peræopods (Pl. XL. fig. 21) extend to or a little beyond the tip of the antennal scales. The carpus is rather longer than the merus, and more than half as long again as the hand.

The second peræopod of a male specimen (Pl. XL. fig. 22) is about two-thirds the length of the body, and the distal end of the merus extends to beyond the middle of the antennal scale. The carpus

is equal in length to the merus, somewhat expanded distally, where the breadth is about one-fifth of the length. The hand is rather wider than the distal end of the carpus, not perceptibly compressed (the two diameters are about as 5 : 6), a little less than twice the length of the carpus Palm shorter than the carpus, and rather shorter than the fingers. Fingers straight, meeting along their whole length; inner margins with smooth cutting-edges, without any trace of teeth save a single very minute tubercle near the base of the dactylus. The surface of the whole limb bears widely-scattered very minute setæ; on the distal part of the carpus and on the inner side of the palm are a number of small spinules. The succeeding pairs of peræopods are long and slender, the fourth pair extending beyond the antennal scale. The dactylus is nearly one-third the length of the propodus.

End of telson (Pl. XL. fig. 24) with a sharp median point, longer than the outer but shorter than the inner pair of terminal spines.

Seven specimens, most of them very imperfect, are in the collection; only one of the large chelæ is preserved. One specimen is a female carrying ova. The species was dredged at a depth of 50 feet.

Length of largest specimen (♂), 25 mm.
Length of ovigerous female, 23 mm.
Length of specimen figured (♂), 18 mm.
Length of 2nd peræopod of same, 11·5 mm.

The very large number of closely-allied species included in the genus *Palæmon*, and the very great differences (as yet only partly elucidated) which may exist between individuals of the same species of different ages and sexes, render it somewhat hazardous to attempt to define a new species from such scanty material. The presence of an ovigerous female in the collection shows that the species is one of the smallest, if not the very smallest species of the genus. On the other hand, we cannot be quite certain that the single male specimen upon which our description is mainly based has attained its full development in the characters of the chela[1].

Assuming, however, for the present that this is the case, the species will fall into the group *Eupalæmon* as defined by Ortmann (Zool. Jahrb., Abth. f. Syst. v. 1891, p. 696), in which the second peræopods are cylindrical, while the equality of the merus and carpus of these appendages and the characters of the telson will bring it into proximity with such species as *P. scabriculus* Heller and *P. endechensis* de Man. *P. niloticus* Roux, the only species known from North Africa, is somewhat similar to the present form, but, so far as can be judged from the more or less defective figures and descriptions of Roux (Ann. Sc. Nat. xxviii. 1833, p. 73,

[1] Since this paper was read I have received several additional and better preserved specimens of both sexes from Mr. Moore's collections. They agree in all essential points with the description given above.

pl. vii. f. 2) and Klunzinger (Zeitschr. f. wiss. Zool. xvi. 1866, p. 357, pl. xx.), appears to present distinctive characters. Both these authors figure the rostrum with a very convex upper edge. Klunzinger gives the number of serrations as $\frac{9\text{-}13}{1\text{-}2}$, Roux figures $\frac{11}{5}$. According to the figures of both authors, however, not more than one tooth appears to be behind the orbit. Both show the carpus of the 2nd peræopod to be distinctly shorter than the merus, and much more than half the length of the hand. Klunzinger's figure of the chela shows it to be more slender, with the palm less inflated and the fingers longer than in our species.

Neither of the species described in this paper can be depended on as throwing any light on the general question of the origin of the Tanganyika fauna. The genus *Palæmon* contains about 50 species, of which only two are said to be marine. It is closely allied to *Leander*, in which, conversely, the marine species greatly predominate, while both genera have numerous allies among the littoral fauna. Whatever bearing the genus *Palæmon* may have on the more general problem of the origin of freshwater faunas, the number of its species, their wide distribution, and lastly the imperfect nature of the specimens from which the present species is described (precluding any conclusion as to its nearest specific affinities) all render it incapable of serving us towards the settlement of the special problem of Tanganyika.

Limnocaridina belongs to the *Atyidæ*, a circumtropical family of freshwater forms whose probably somewhat distant allies are supposed by Ortmann to be found in the deep-sea *Acanthephyridæ*. It is a near ally of *Caridina*, an extensive genus, of which one species is known from the West Indies, while the rest occupy countries bordering on the Indian Ocean from S. Africa to Australia; one species occurs in the Nile and the rivers of Algeria. One species, *C. wyckii*, has a range extending from East Africa to Queensland and Celebes. It is noteworthy from the point of view of the present case that *Caridina* is not known to occur in West Africa. Our form from Tanganyika is in the meantime an isolated species, and the characters that it presents are not those of a primitive type, but rather of a somewhat specialized form.

EXPLANATION OF THE PLATES.

Plate XXXIX.

Fig. 1. *Limnocaridina tanganyikæ*, g. et. sp. n., ♀, p. 704.
2. " " Carapace and rostrum.
3. *Caridina wyckii* (Hickson), p. 705. Anterior part of carapace.
4. *Limnocaridina tanganyikæ*, p. 704. Peduncle of antennule.
5. " " Mandibles.
6. " " First maxilla.
7. " " Second maxilla.
8. " " First maxilliped.
9. " Third maxilliped. 9*a*. Terminal joint of third maxilliped.

PLATE XL.

Fig. 10. *Limnocaridina tanganyikæ*, p. 704. First peræopod, outer side.
10 *a*. First peræopod, inner side.
11. „ „ Second peræopod.
12. „ „ Dactylus of fourth peræopod.
13. „ „ Fifth peræopod. 13 *a*. Dactylus of same.
14. „ „ First pleopod of female.
15. „ „ First pleopod of male.
16. „ „ Second pleopod of female.
17. „ „ Second pleopod of male. 17 *a*. *Appendix masculina* and *App. interna* of same.
18. „ „ Tail-fan.
19. „ „ Apex of telson.
20. *Palæmon moorei*, p. 709. Carapace, ♂.
21. „ „ First peræopod (more highly magnified).
22. „ „ Second peræopod.
23. „ „ Fourth peræopod.
24. „ „ Apex of telson.

June 6, 1899.

Dr. HENRY WOODWARD, F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of May 1899:—

The total number of registered additions to the Society's Menagerie during the month of May was 95, of which 47 were by presentation, 7 by purchase, 36 were received on deposit, and 5 were born in the Menagerie. The total number of departures during the same period, by death and removals, was 110.

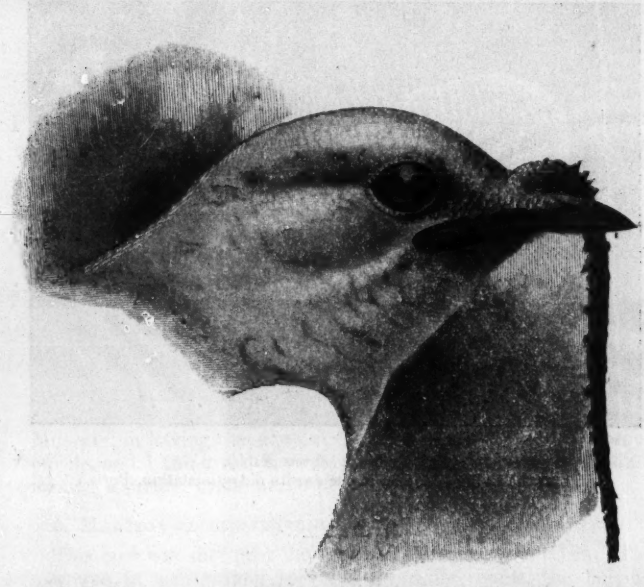
Among the additions may be specially noticed:—

1. A fine young male of the Mountain Zebra (*Equus zebra*), purchased May 6th, and making a pair with the female acquired by the Society on May 4th, 1898, from the Amsterdam Gardens.

2. An example of the curious Musk Duck (*Biziura lobata*) from Australia, purchased May 30th, of which specimens have been previously exhibited only on one occasion (see P. Z. S. 1882, pp. 311–455).

I also take this opportunity of exhibiting a careful drawing by Mr. Smit of the head of the Carunculated Bell-bird (*Chasmorhynchus niveus*) now living in the Insect-house (obtained by purchase

Sept. 3rd, 1896), in order to show the way in which the caruncle on the top of the bill is usually carried in life. It should be remarked that the caruncle is often considerably shortened, and at times only appears as a horn-like projection scarcely as long as the bill itself. The caruncle may hang down on either side.

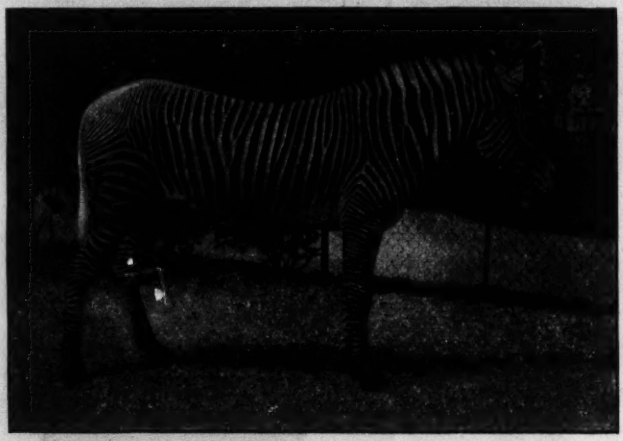


Head of Carunculated Bell-bird.

Mr. Sclater exhibited a photograph (kindly transmitted to him by Mons. Porte) of the fine female specimen of Grévy's Zebra presented to the President of the French Republic by the Emperor Menelek, and received at the Jardin Zoologique d'Acclimatation in September 1898. Mr. Sclater spoke of the large size and great beauty of this animal, which he had lately had an opportunity of inspecting. It stood about 5 feet in height at the withers.

Mr. Sclater stated that he was still hoping to obtain an example of this Zebra for the Society's Collection, and read an extract from a letter addressed to him by Capt. J. L. Harrington, H.B.M. Envoy to Abyssinia, stating that the matter was receiving

his best attention, and that he hoped, if he returned to England in July, to bring with him a Grévy's Zebra, or perhaps even a pair.



Grévy's Zebra (*Equus grevii*).
(From the living specimen in the Jardin d'Acclimatation, Paris.)

Mr. A. Blaynay Percival, F.Z.S., exhibited a series of Bird-skins which he had lately obtained at Chiromo in British Central Africa; also some Insects from the same locality.

Mr. Percival read the following notes on the Birds :—

1. Machærhamphus anderssoni.

This bird is a night-flier, and is a rare species.

My specimen was obtained one evening in the early part of August, 1898, while I was waiting for ducks. In flight it much resembles a falcon; in fact, until it came to hand I thought it was one. Its stomach was quite empty and the bird itself was in very poor condition. It is a young male in changing plumage.

One other example was seen near the Shiré River, some 25 miles from where I obtained my specimen. I spent almost the whole of one night watching for it, then told my gun-boy to stay, and promised him a reward if he got the bird; he saw it on the following evening, but did not get a shot. Later on he brought me a female *Polyboroides typicus*, which he said was the right bird, and was anxious to have the reward.

2. MEROPS NUBICOIDES.

During the months of October and November these birds were numerous on the Ruo and Shiré Rivers, breeding in colonies in the steep banks of those rivers in company with *M. bullockoides*. On the Ruo, the native children snare scores of them by setting a noose in the entrance to the nest. In one place I am sure I saw fifty snares set.

3. EURYSTOMUS AFER.

These birds were not seen until November, when they appeared in small parties of six or eight and were very noisy. Soon after arrival they broke up into pairs and became much quieter. They are not easily shot, being very wary and perching on the highest trees, if possible on a dead branch.

4. PSALIDOPROCNE sp. nov.

This small but interesting Swallow was obtained at the end of August, 1898, on the River Ruo. It was in considerable numbers on this one occasion only, and during the nine months I stayed in the district I never saw it again. It was flying high in the bright sunshine, unlike *Psalidoprocne antinorii*, which is seldom seen before dusk, then flying low down and usually among the trees.

My specimen differs from the type of *P. antinorii*, in the British Museum, in having the gloss of the back greenish black instead of purple, and I think it differs in some other points, but I intend making a further examination of it.

5. HALCYON PALLIDIVENTRIS.

This bird was shot near the nest and the eggs were taken. The nest was in soft ground beside a dry water-course, the hole in which the nest was placed being about 3 feet deep. I was trying to get at the female, which had flown out of the nest, when the male joined her and was shot, but I was unable to secure the female.

Mr. Boulenger exhibited some living specimens of the "Harmut," *Clarias lazera* C. & V., from Damietta, believed to be the first examples of this curious Siluroid Fish imported alive to this country. Mr. Boulenger was not able to confirm from personal experience the account of its terricole habits that had been given by Dr. Sourd from Senegal specimens determined by Prof. Vaillant as *Clarias lazera* (Bull. Mus. H. N. 1895, p. 271). Specimens placed by Mr. Boulenger in a terrarium carpeted with turf had died after periods varying between one and three days.

Dr. S. F. Harmer, F.R.S., gave an account of the remains of a Deer in the University Museum of Zoology at Cambridge, obtained from the Forest-Bed series at Parkfield, near Lowestoft, and belonging to

the form usually known as *Cervus verticornis* Dawk. The cranial portion of the skull was well preserved; the antlers had a spread of 6 feet, measured in a straight line, and the atlas and axis vertebræ had been found associated with the skull.

The specimen was of interest, not only from its unusually perfect condition, but as throwing further light on the characters and affinities of the species, remains of which had been found in large numbers in the Forest-Bed series, but had usually consisted solely of the basal part of the antlers. The restorations which had been published of the distal portions of the antlers were quite misleading, and were responsible for the statement commonly made that the antlers of this species are short and thick and that the crown ends in two points. The antlers were, on the contrary, comparable in their general proportions with those of the Fallow Deer and Irish Deer, and ended moreover in a broadly palmated crown, the edge of which was gently scalloped instead of being produced into long snags. The arrangement of the tines and of the palmation agreed closely with that in the species just mentioned, thus confirming the view that the Forest-Bed form was closely related to its ancestors.

The question of nomenclature was considered, with the result that *C. verticornis* of the Forest-Bed was probably identical with *C. carnutorum* Laug., and was a synonym of *C. belgrandi*, Lart.

This paper will be printed in full in the 'Transactions.'

The following papers were read:—

1. An Account of a Collection of Fishes made by Mr. R. B. N. Walker, C.M.Z.S., on the Gold Coast. By Dr. A. Günther, F.R.S., F.Z.S.

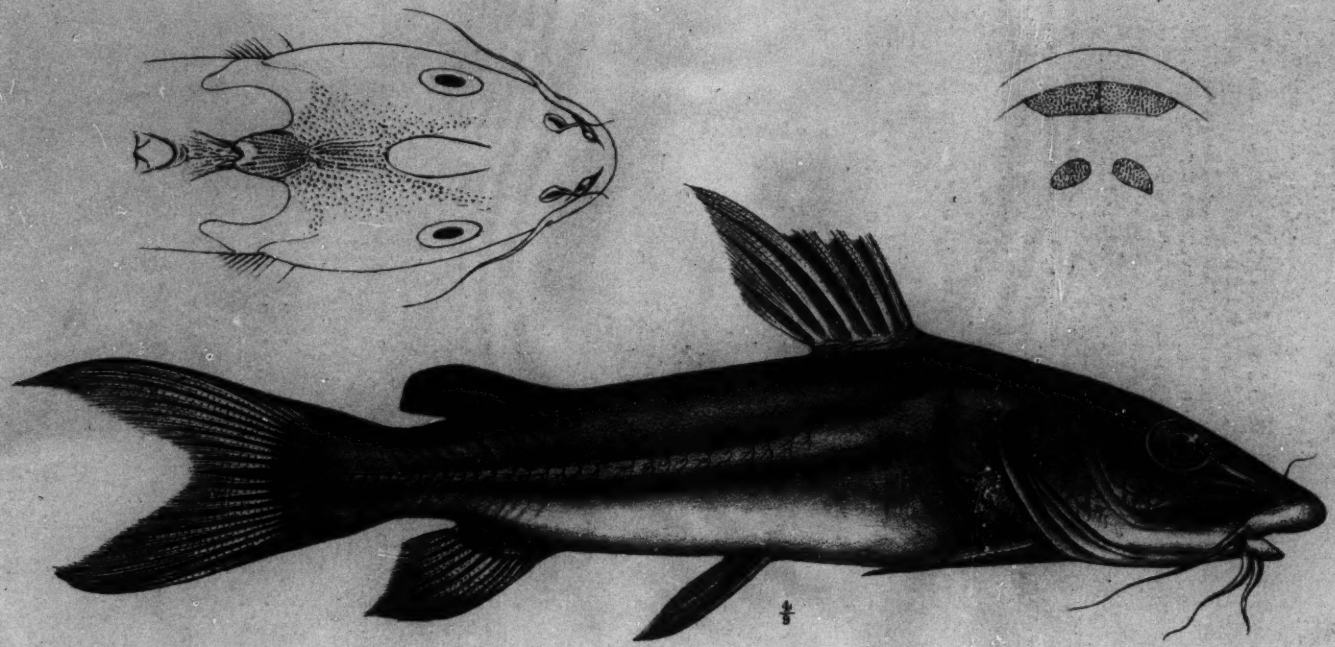
[Received April 22, 1899.]

(Plates XLI.–XLV.)

Mr. R. B. N. Walker, C.M.Z.S., to whom we are indebted almost for the first information on the freshwater fishes of the Gaboon country[1], has brought home a small collection which he formed during a visit to the Gold Coast in the course of last year, and which he has kindly entrusted to me for examination, with instructions to deposit a selection of the specimens in the Natural History Museum.

The collection, small as it is, proved to be of considerable interest, not only because it contained some forms new to this fauna

[1] See Ann. & Mag. N. H. 1867, p. 109.



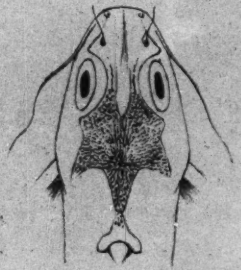
J.Green del. et lith.

CHRYSICHTHYS BÜTTIKOFERI, AD.

Mintern Bros. imp.

BRITISH
130099
MUSEUM

A.



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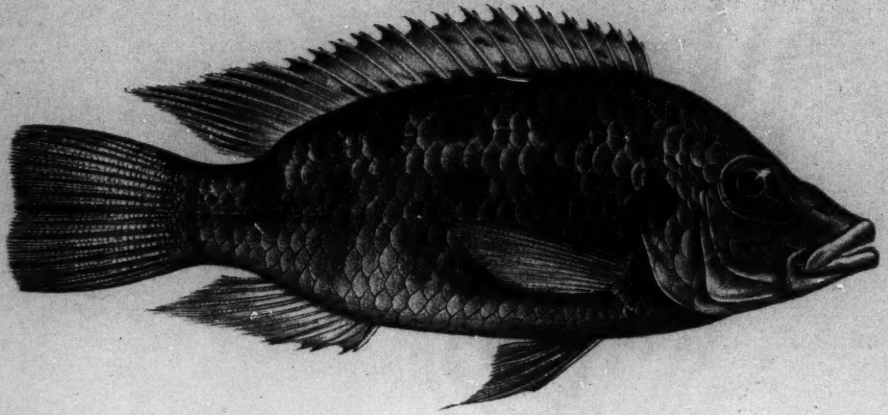

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A. CHRYSICHTHYS BÜTTIKOFERI. juv B. HEMICHROMIS TERSQUAMATUS.

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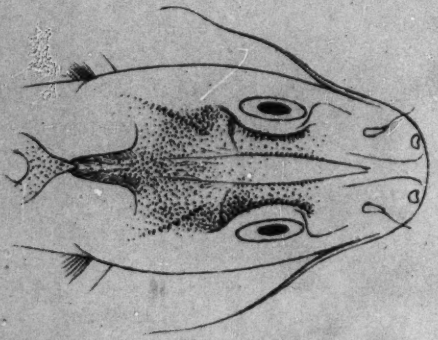

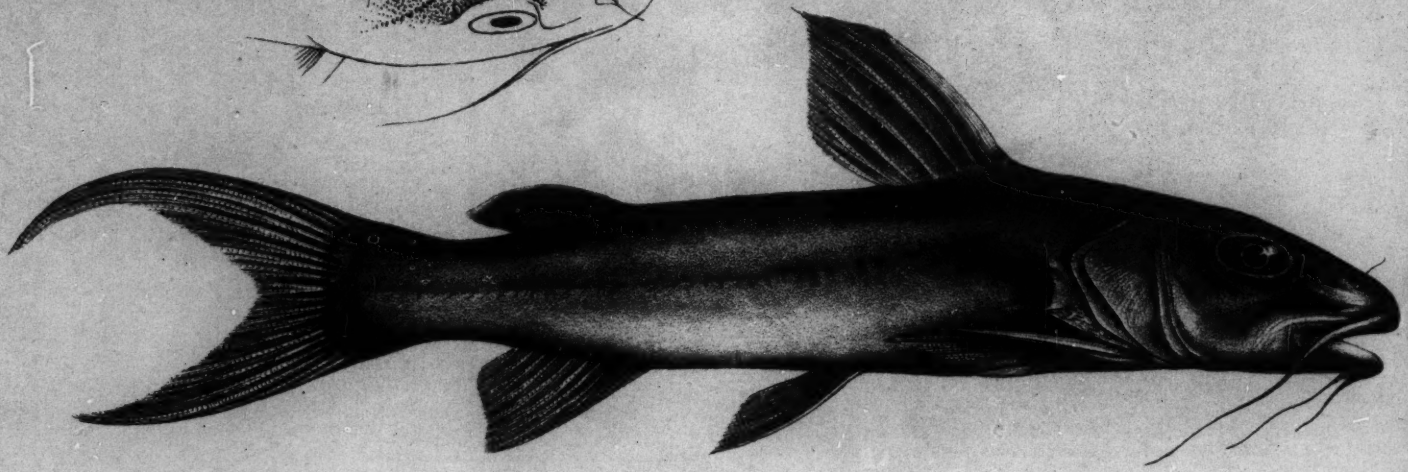

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J.Green del et lith.

Mintern Bros. imp.

CHRYSICHTHYS PERSIMILIS.

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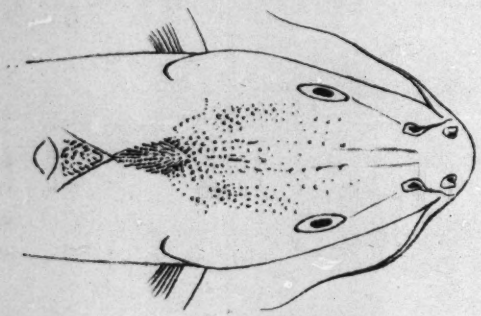
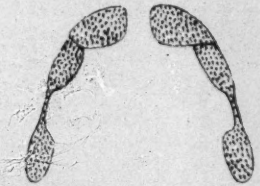
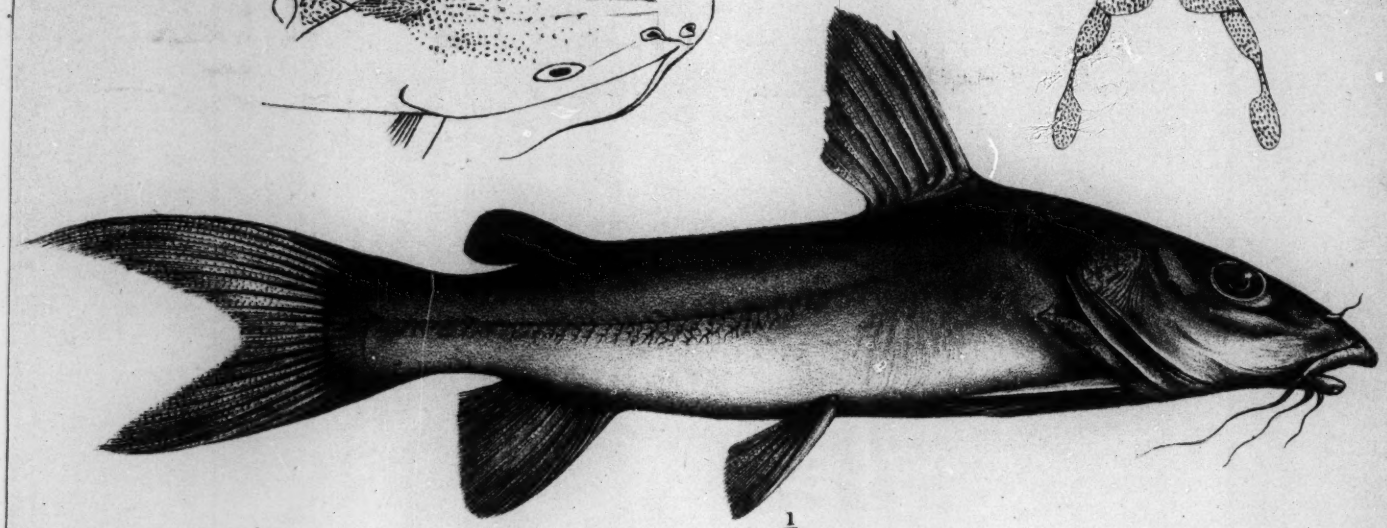
130099
MUSEUM







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J.Green del. et lith.

Mintern Bros. imp.

CHRYSICHTHYS CAMERONENSIS.

BRITISH
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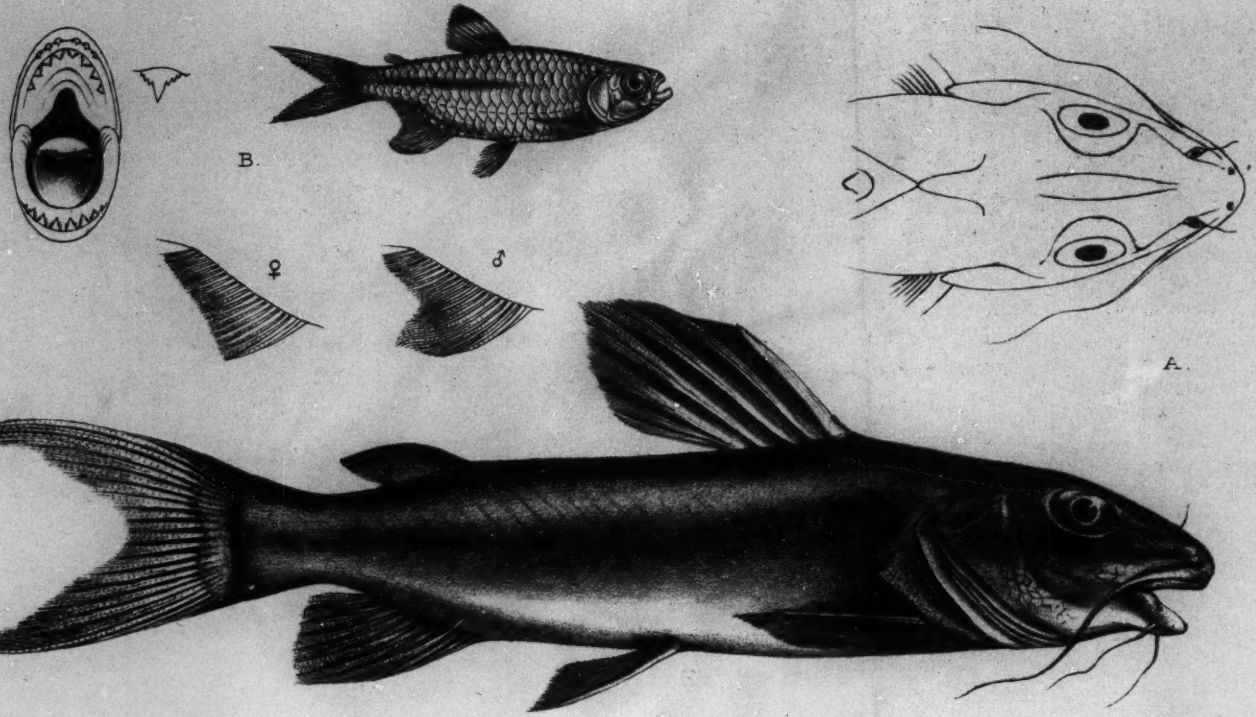
MUSEUM



J. Green del. et lith.

Mintern Bros. imp.

A. CHRYSICHTHYS KINGSLEYÆ. B. PETERSIUS OCCIDENTALIS.

BRITISH
130099
MUSEUM

(*Haplochilus infra-fasciatus*, *Petersius*), but also because it has led to a more critical revision of the Gaboon species of *Chrysichthys*, which are more numerous and more difficult of discrimination than I was formerly inclined to admit.

The specimens were collected at the following localities:—

1. On the River Prah, which falls into the sea at Chama, lat. 5°, long. 2° 30′; a tortuous river with numerous small rapids separated by sluggish pools, its course being chiefly in the Denkera country.

2. On the River Offim, one of the most considerable affluents of the Prah, and very similar to it; its course is through the Ashantee country.

3. On the River Kotchwah, a tributary of the Emissa, which also falls into the sea a little east of Saltpond.

4. On the Sweet River or Kakum, a small river falling into the sea between Elmina and Cape Coast Castle.

Ordinary maps give only an indistinct indication of these rivers, and Miss Kingsley informs me that their topography is all the more perplexing, as most of the rivers have two names, one in the Ya, and the other in the Fantee language.

CHROMIS OGOWENSIS.

Chromis ogowensis, Günth. Ann. & Mag. N. H. 1896, April, p. 271.

I refer two specimens from the Prah River, two from the Kotchwah R., and three from the Kakum R. to this species. They show only some insignificant differences in the general form of the head. All possess 8 anal rays. The formula of the dorsal fin is $\frac{1}{11}$ in five specimens, and $\frac{1}{13}$ and $\frac{1}{12}$ in two, both these latter specimens coming from the Kakum R. In all the teeth are numerous, viz., from 25 to 29 on each side of the upper jaw. Number of gill-rakers on the outer branchial arch from 13 to 17.

HEMICHROMIS TERSQUAMATUS, sp. n. (Plate XLII. fig. B.)

D. $\frac{1}{11}$. A. $\frac{3}{7}$. L. lat. 28. L. transv. 3/10.

Teeth in a double series, those of the inner being minute and rudimentary. The height of the body is contained $2\frac{1}{2}$ times in the total length (without caudal), the length of the head $2\frac{2}{3}$ times. Snout with the upper profile straight. Eye a little nearer to the end of the operculum than to that of the snout, and contained $1\frac{2}{3}$ times in the length of the latter. Interorbital space barely wider than the orbit. Maxillary not reaching to the vertica from the orbit. Cheek with three series of scales. Gill-rakers short and transverse, 11 on the lower branch of the outer arch. Posterior dorsal spines very little longer than the middle ones, the last being two-fifths of the length of the head. Pectoral about as long as ventral, which reaches to the vent. Caudal rounded. Caudal peduncle a little deeper than long. Scales smooth. Body with traces of five broadish dark cross-bands, which are darkest in the middle of the body, where they have the

appearance of large spots; the foremost of these spots is the one on the operculum. A series of black spots along the base of the dorsal fin, each spot covering the base of a spine; another less complete submarginal series.

One specimen, 130 millim. long, from the Kotchwah River.

This species is closely allied to the one which I have identified (with doubt) with *Hemichromis schwebischi*, Sauvage (Ann. & Mag. N.H. 1896, xvii. p. 273), and which Mr. Boulenger—after comparison with the type of the latter—declares to be distinct, describing and figuring it under the name *Chromidotilapia kingsleyæ*, P. Z. S. 1898, p. 151, pl. xix. fig. 2. Some of the front teeth of the Kotchwah specimen are bent inwards, though not quite so conspicuously as in the larger of the specimens of *Chromidotilapia* (96. 5. 5. 38); but I cannot attach any value to this supposed generic character, as a younger specimen of *Chromidotilapia kingsleyæ* (119 millim. long; 96. 5. 5. 36) has the teeth much less strongly bent than the older one.

Chrysichthys.

Chrysichthys, *Octonematichthys*, *Melanodactylus*, Bleeker (1858).
Chrysichthys Günther (1864).

Mr. Walker's collection contained a number of specimens of this genus, which evidently belonged to several species. In order to name them, and to compare them with others from previous collections with the determination of which I did not feel satisfied, I have been led to revise the whole of the material which I had brought together for the British Museum collection. The following notes on the several species are the results of this examination.

I paid special attention to the disposition of the teeth on the palate, and I convinced myself that I was right (Cat. Fish. v. p. 70) in declining to use modifications, which in some of the species are subject to individual variation, for the establishment of genera, as has been done by Bleeker. I have also questioned the propriety of separating *Clarotes* from *Chrysichthys*, stating my reasons (pp. 71, 73), which, however, weighed so little with that ichthyologist that he placed these genera in the 'Atlas Ichthyologique' into two distinct groups, separated by forms like *Doras*, *Synodontis*, &c.

Chrysichthys auratus (Geoffr.).

Chrysichthys auratus Günth. Cat. Fish. v. p. 71.

I refer, for the present, to this species a young specimen, 150 millim. long, from the River Prah, as well as several still younger ones from the River Offim. The eye of these young specimens is, of course, larger than in an adult example from the Nile, the only one I have for comparison. Also the skin on the upper surface of the head is much less thick, which, again, may be accounted for by the difference in age. On the other hand, there are many

important points of agreement, such as the stout habit of the body, the very broad, short, depressed snout, the very wide mouth, the long band of teeth on the palate, which extends on to the palatine

Fig. 1.

Chrysichthys auratus.

bones, and the long adipose fin. A point of little significance is the comparative length of the pectoral spine, which in the Prah specimen is as long as the dorsal spine.

CHRYSICHTHYS MACROPS Gthr.

Some specimens from West African localities which I formerly referred to this species I am now, with more materials before me, able to distinguish as distinct, so that, so far as I know, this species seems to be restricted to the Nilotic system. There are seven specimens in the collection of the Natural History Museum: one obtained by Rüppell on the Lower Nile, and the six others collected by Petherick at Khartoum; one of the latter is made into a skeleton. These specimens vary in length from 155 to 210 millim., and are most instructive, showing a remarkable variation in the

Fig. 2.

Chrysichthys macrops.

backward extent of the teeth of the palate, while all have the first dorsal ray and upper caudal lobe prolonged into a filament.

In none of the specimens is the dentition of the palate perfectly symmetrical, the vomerine band on one side being sometimes longer than on the other, or rudimentary palatine teeth being visible on one side, which are entirely absent on the other. Palatine teeth

may be present or absent, and their development is not dependent on the size of the fish. Thus, in a specimen of 155 millim.[1] the teeth are limited to the vomer, forming two narrow, tapering, oblique patches, without a trace of palatine teeth. In three others (of 162, 190, and 210 millim., Rüpp.) the patches on the vomer are much the same shape, or more band-like, but on the right palatine rudimentary teeth may be seen. In the specimen of 210 millim. the vomerine bands are longer, and behind the end of the band on the left side there is a very small separate patch of palatine teeth. In one specimen of 185 millim. there are distinct palatine teeth, continuous with the vomerine band. Finally in the last (185 millim. skel.) the palatine teeth are likewise present, though not symmetrically developed.

CHRYSICHTHYS WALKERI, sp. n.

The height of the body is contained four times in the total length (without caudal), the length of the head $3\frac{2}{5}$ times; caudal peduncle rather longer than deep. Head broader than high, its greatest depth being contained $1\frac{2}{3}$ times in its length. The greater portion of its upper surface (with the exception of the snout) is finely granulated, or covered with only a thin film of skin; occipital process longer than the basal bone of the dorsal spine, both meeting a little behind the middle of the nape. Snout short, one third of the length of the head, rather broad, depressed, with the upper profile descending in a gentle curve. Mouth wide, much wider than the distance between the eyes. Nasal barbels thin, as long as or longer than the eye; maxillary and outer mandibulary barbels reaching beyond the gill-opening, if stretched backward. Inner mandibulary barbels slightly anterior to the outer, and half a diameter of the eye distant from each other. The teeth on the palate are confined to the vomer, and form a narrow crescentic band, slightly interrupted in the middle in front. The band of

Fig. 3.

Chrysichthys walkeri.

intermaxillary teeth is somewhat narrowed on the sides, each half being twice as broad as long. The width of the bony interorbital space is $\frac{2}{3}$ of the diameter of the eye, which is contained $1\frac{1}{3}$ times in the length of the snout and $3\frac{2}{3}$ times in that of the head. Dorsal fin not elevated; the length of its base is two thirds of its distance from the adipose fin, the base of which equals, or is but little shorter than, that of the dorsal. Dorsal spine as long as the

[1] Not including the caudal filament in these measurements.

head without snout or as the spine of the pectoral, very slightly serrated along its posterior, and nearly smooth along its anterior edge. Anal fin not reaching the caudal, when laid backward, with 11 or 12 rays, 7 or 8 of which are branched. Caudal fin deeply cleft, with the upper lobe as long as the head. Upper parts greyish brown, lower silvery.

Three specimens from the River Prah, 91 and 139 millim. long.

This species represents in the Gaboon rivers the Nilotic *Chrysichthys macrops*, to which it is closely allied. In that species, however, the anterior dorsal ray is greatly prolonged, even in specimens which exceed the Prah fishes only slightly in length.

CHRYSICHTHYS BÜTTIKOFERI Steind. (Plates XLI. & XLII. fig. A.)

Chrysichthys büttikoferi Steindachner, Notes Leyden Mus. xvi. p. 60 (1894).

The examination of a small number of (chiefly young) specimens of *Chrysichthys* from various localities in the Gaboon country has been attended with much difficulty and uncertainty. A *part* of them seemed to be identical with, or closely allied to, *Ch. büttikoferi* (Steindachner). Although they show certain slight differences in the number of anal rays, extent of the tooth-patches on the palate, form and comparative length of the snout, size of the eye, and length of the dorsal and caudal rays, Steindachner's description applied more or less perfectly to all. However, the series of specimens of any species from the same locality is still so incomplete that we are much in the dark as to individual variations, the changes these fishes undergo with age, or as to any secondary sexual characters. Some years ago I should not have hesitated to refer all these specimens to the same species *Ch. büttikoferi*, and I am not by any means certain that this will not prove to be the proper course to pursue, when sufficient materials are brought together; but since more recent investigations of the West African Fauna have shown the wide distribution and great specific development of this genus, I am induced, after long hesitation, to distinguish among the forms allied to *Ch. büttikoferi* several under distinct names.

The question, then, arises for which of the forms, distinguished here, the name given by Steindachner should be retained. Steindachner's type came from Liberia, is a unicum, and young, being 20½ centim. long. I am indebted to Dr. Jentink for a sketch of this type as well as of its dentition. Unfortunately the specimen presents those elements of uncertainty which render the study of these fishes so difficult. As will be seen from the accompanying sketch, the two patches of larger vomerine teeth are connected with each other by, and are in fact only a portion of, a larger horseshoe-shaped band of minute rudimentary vomerine teeth, extending backward on the palatine bones. In the River Prah specimens referred by me to *Ch. büttikoferi* only the two patches of larger teeth are visible, but none of the rudimentary ones.

Nevertheless, having found that the extent of the dentition in the species of this genus should be used as a taxonomic character with great caution only, and all the more so the younger the specimens are, I cannot make up my mind to employ a distinct name for the Prah specimens.

Fig. 4.

Chrysichthys büttikoferi (type).

I have before me one adult specimen 17 in. long, and four small ones 5 or 6 in. long; they were obtained at the same locality on the River Prah and at the same time, so that there cannot be any doubt that all five belong to the same species. In appearance, and especially in the form of the head, the young differ so much from the old that if they had been obtained at a more distant locality it would have been impossible to recognize their specific affinity. I therefore give here descriptive diagnoses of both adult and young.

Adult (Pl. XLI.).—The height of the body is contained $4\frac{1}{3}$ times in the total length (without caudal), the length of the head $3\frac{1}{3}$; caudal peduncle two thirds as long as high. Head broader than high, its greatest width being two thirds of its length; the greater portion of its upper surface is covered with thin, soft skin, but the granulated parts of the bones on the nape and crown of the head are exposed or covered only with a thin film of skin; occipital process rather longer than the basal bone of the dorsal spine, both meeting a little behind the nape. Snout rather long, narrowed towards the end, depressed, its length being two fifths of that of the head; upper jaw projecting beyond the lower; mouth of moderate width, as wide as the distance between the eyes. Nasal barbels thin, about as long as the eye; maxillary barbels reaching beyond the orbit, outer mandibulary barbels to the gill-opening; mandibulary barbels inserted in nearly the same straight line, the inner being slightly anterior and less than a diameter of the eye distant from each other. The teeth on the palate are confined to the vomer, being placed in two ovate groups, which are less than half a diameter of the eye distant from each other. The band of intermaxillary teeth tapers outward, each half being twice as broad as long. The width of the bony interorbital space is more than that of the orbit, which is two fifths of the length of the snout, and one sixth of that of the head. Dorsal fin (mutilated) of moderate height; the length of its base is two fifths of its distance from the adipose fin, and not quite twice as long as the base of the latter

Anal fin reaching the caudal, if laid backward, with 13 rays, 8 of which are branched. Caudal fin deeply cleft, with the upper lobe at least as long as the head. Pectoral spine (broken) serrated along both edges. Upper parts greyish olive, sides and abdomen silvery.

Seventeen inches long (433 millim.).

Young (Pl. XLII., fig. A.)—The height of the body is contained $4\frac{2}{3}$ times in the total length (without caudal), the length of the head $3\frac{2}{5}$; caudal peduncle three fifths as high as long. Head as high as broad, its greatest width being equal to the length of the head without snout. Granulations on the upper side of the head and form of the nuchal bones as in the adult. Snout of moderate extent, with the upper profile rather curved; its length is one third, or a little more than one third, of that of the head; upper jaw more or less projecting beyond the lower; mouth of moderate width, wider than the distance between the eyes. Nasal barbels thin, half as long as the eye; maxillary and outer mandibulary barbels reaching to, or even beyond, the gill-opening, if laid backward; inner mandibulary barbels distinctly anterior to the outer, and distant from each other about half a diameter of the eye. The teeth on the palate and intermaxillary are placed as in the adult. The width of the bony interorbital space is scarcely more than half that of the orbit, which is rather less than the length of the snout, and contained $3\frac{1}{4}$ times in that of the head. Dorsal fin rather high, reaching to, or nearly reaching to, the adipose, when laid backward; the length of its base is one half, or a little more than one half, of its distance from the adipose, and exceeds the length of the base of the latter. Dorsal spine serrated along both its edges in its upper portion, and rather shorter than the head. Anal fin reaching or nearly reaching the caudal, if laid backward, with 14 rays, 8 of which are branched. Caudal fin very deeply cleft, both lobes longer than the head. Pectoral spine stronger, but rather shorter than that of the dorsal fin. Upper parts greyish olive; sides and abdomen silvery.

Five and six inches long (130 and 155 millim.).

CHRYSICHTHYS OGOWENSIS, sp. n.

Chrysichthys büttikoferi, part., Günth. Ann. & Mag. N. H. 1896, April, p. 276.

The height of the body is contained $4\frac{1}{2}$ times in the total length (without caudal), the length of the head $3\frac{1}{2}$ times; caudal peduncle two thirds as high as long. Head a little broader than high, its greatest depth being two thirds of its length; the greater portion of its upper surface is covered with thin soft skin, but the granulated parts of the bones on the nape and crown of the head are exposed or covered with a thin film of skin; occipital process longer than the basal bone of the dorsal spine, both meeting a little behind the middle of the nape. Snout rather long, depressed, with the upper profile straight, obliquely descending; its length is

contained $2\frac{2}{5}$ times in that of the head; upper jaw projecting beyond the lower; mouth rather wide, a little wider than the distance between the eyes. Nasal barbels half as long as the eye; maxillary and outer mandibulary barbels not reaching the gill-opening, if stretched backward; mandibulary barbels inserted in a nearly straight line, the inner being slightly anterior and half a diameter of the eye distant from each other. The teeth on the

Fig. 5.

Chrysichthys ogowensis.

palate form a rather broad crescent, interrupted in the middle in front, the toothless space being one third as wide as the eye; the teeth may or may not be confined to the vomer[1]. The band of intermaxillary teeth tapers outward, each half being twice as broad as long. The width of the interorbital space is three fourths of that of the orbit, which is contained $1\frac{2}{3}$ in the length of the snout and $4\frac{1}{3}$ times in that of the head. Dorsal fin of moderate height, not extending to the adipose, if laid backward; (dorsal and pectoral spines broken). The length of the base of the dorsal fin is a little less than one half of its distance from the adipose, and about twice as long as the base of the latter. Anal fin not reaching the caudal when laid backward, with 14 rays, 9 of which are branched. Caudal fin deeply cleft, with the upper lobe rather longer than the head. Upper parts olive-coloured, sides and abdomen silvery.

Kondo-Kondo, on the Ogowe River (one specimen 194 millim. long).

The principal character by which this species differs from *Ch. büttikoferi* (s. str.) is the greater development of the teeth on the palate.

CHRYSICHTHYS CORISCANUS, sp. n.

Chrysichthys büttikoferi, part., Günth. Ann. & Mag. N. H. 1896, April, p. 276.

The height of the body is contained $4\frac{1}{2}$ times in the total length (without caudal), the length of the head $3\frac{1}{3}$ times; caudal peduncle two thirds as high as long. Head scarcely broader than high, its

[1] They are confined to the vomer on the right side, but on the left they are continued on the palatine as a short patch, slightly separated from the vomerine band.

greatest width being two thirds of its length. The greater portion of the upper surface of the head is granulated, or covered only with a thin film of skin; the snout, as usual, is covered with soft skin. Occipital process longer than the basal bone of the dorsal spine, both meeting behind the middle of the nape. Snout of moderate length, narrowed towards the end, with the upper profile descending in a curved line; its length is one third of that of the head. Upper jaw slightly overlapping the lower; mouth of moderate width, as wide as the distance between the eyes. Nasal barbels minute, about one-third the width of the eye; maxillary barbels reaching the gill-opening, outer mandibulary barbels not reaching the gill-opening, if stretched backward; mandibulary barbels inserted in a straight line, the inner being one third of the diameter of the eye distant from each other. The teeth on the palate are confined to the vomer, being placed in two small groups which are distant from each other about one fourth of the diameter of the eye[1]. The band of intermaxillary teeth is scarcely tapering outward, each half being two thirds as long as broad. The width of the bony interorbital space is three fifths of the diameter of the eye, which is four fifths of the length of the snout, and contained $3\frac{1}{3}$ times in that of the head. Dorsal fin rather high, but not reaching the adipose fin, if laid backward; the length of its base is one half, or a little less than one half, of its distance from the adipose fin, and nearly twice as long as the base of the latter. Dorsal spine as long as the head without snout, with indistinct posterior serrature in its upper half. Anal fin not reaching the caudal, if laid backward, with 12 rays, 7 of which are branched. Caudal fin deeply cleft, with the upper lobe rather longer than the head. Pectoral spine as long as that of the dorsal fin, smooth along the outer edge. Upper parts greyish olive, sides and abdomen silvery.

Corisco Isld. (two specimens, 148 and 163 millim. long).

The principal character by which this species differs from *Ch. büttikoferi* (s. str.) is the smaller number of anal rays.

CHRYSICHTHYS LAGOENSIS, sp. n.

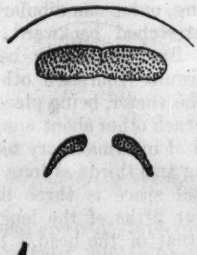
Chrysichthys macrops, part., Günth. Ann. & Mag. N. H. 1867, Aug. p. 111.

The height of the body is two ninths of the total length (without caudal), the length of the head rather less than one third. Caudal peduncle two thirds as high as long. Head a little broader than high, its greatest depth being two thirds of its length; the greater portion of its upper surface is granulated. Occipital process rather broad, as long as the basal bone of the dorsal spine, both meeting in the middle of the nape. Snout long, two fifths of the

[1] The two specimens are not quite alike in this respect; on the right-hand side of the larger specimen, the patch of teeth is continued backward in a single series of about six minute teeth. In the smaller specimens the two vomerine patches are rather more approximated than in the larger.

length of the head, broad, with the upper profile descending in a gentle curve. Mouth wide, wider than the distance between the eyes, with the upper jaw overlapping the lower. Nasal barbels minute; maxillary barbels extending to the margin of the præoperculum; outer mandibulary barbels not reaching the gill-opening; inner mandibulary barbels anterior to the outer, and less than half a diameter of the eye distant from each other. The vomerine

Fig. 6.



Chrysichthys lagoensis.

teeth are disposed in a narrow band on each side, tapering behind, the two bands being separated in front by a toothless space, less than half a diameter in width; however, on the right side there are vestiges of another narrow tooth-band, stretching across the junction of the vomer with the palatine.[1] Each half of the intermaxillary band rounded at its lateral extremity, half as long as broad. The width of the bony interorbital space is more than the diameter of the eye, which is two fifths of the length of the snout and one fifth of that of the head. Dorsal fin elevated and enlarged, reaching the adipose when laid backward; the length of its base is one half of its distance from the adipose fin, and double the length of the base of the latter. Dorsal spine rather longer than the head without snout, and longer than the pectoral spine; it is slightly roughened in front, and feebly denticulated behind. Anal fin reaching the caudal, when laid backward, with 11 rays, 7 of which are branched, the last split to the base. Cleft of the caudal of moderate depth, the upper lobe as long as the head. Upper and lateral parts brownish, lower white.

Lagos (Nat. Hist. Mus. 66.3.8.16). Length 377 millim.

A form intermediate between *Ch. nigrodigitatus* and *Ch. macrops*.

A number of very young specimens, collected by Mr. Walker on the River Offim, belong to a species most closely allied to *Ch. lagoensis*, but it would be hazardous to refer them to that species

[1] Of course, this condition cannot be regarded as a specific character, but I describe it as I find it in the only specimen available.

without knowing more of the changes that must take place during growth.

CHRYSICHTHYS NIGRODIGITATUS Lacép.

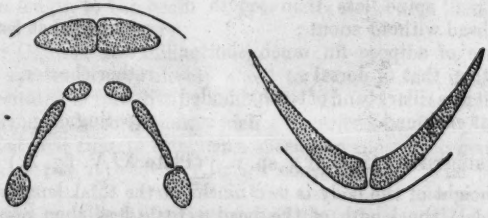
Of this species two specimens are in the Natural History Museum; it is not known from what West African river they were obtained. One measures 280 millim., the other 130 millim. in length, excluding the caudal fin. In spite of the great difference in size, both agree in form of the snout, in the great development of the dorsal fin, prolongation of caudal lobes, number of anal rays (nine branched), &c. Only the eye is very much larger in the younger specimen, as might be expected. In both, the teeth of the palate are confined to the vomer, and appear in the young as two small, oblique, ovate patches; in the older specimen the two patches are produced behind into a narrow tract of teeth.

CHRYSICHTHYS PERSIMILIS, sp. n. (Plate XLIII.)

Chrysichthys macrops, part., Günth. Ann. & Mag. N. H. 1867, xx. p. 111.

The height of the body is one fifth of the total length (without caudal), the length of the head a little less than one third. Caudal peduncle two thirds as high as long. Head a little broader than high, its greatest depth being contained $1\frac{3}{4}$ times in its length. The greater portion of its upper surface is granulated, but covered with a thin film of skin; occipital process longer than the basal bone of the dorsal spine, both meeting a little behind the middle of the nape. Snout long, three eighths of the length of the head, broad, rather depressed. Mouth of *great width*, extending to

Fig. 7.



Chrysichthys persimilis. Upper and lower teeth

below the middle of the distance between eye and nostril, much wider than the distance between the eyes. Nasal barbels small and short, about half as long as the eye. Maxillary barbels reaching to, outer mandibulary barbels not reaching to, the gill-opening when stretched backward. Inner mandibulary barbels anterior to the outer, half a diameter of the eye distant from each other. The teeth on the palate occupy vomer and palatine bones, and

are disposed in three divisions (more or less continuous) on each side; the anterior division is a small rounded patch, the middle a narrow band stretching from vomer to palatine, the posterior on the palatine a rather broad ovate patch. The band of intermaxillary teeth tapers outward, and each half is half as long as broad; *the length of the mandibulary band of teeth is contained* $2\frac{2}{3}$ *times in that of the head.* The width of the bony interorbital space equals the diameter of the eye, which is contained $1\frac{3}{4}$ times in the length of the snout and $4\frac{2}{3}$ times in that of the head. Dorsal fin not elevated; the length of its base is one half of its distance from the adipose fin, the base of which is rather less than that of the dorsal. Dorsal spine shorter than the head without snout, equal in length to the pectoral spine, smooth in front, serrated behind. Anal fin not reaching the caudal, when laid backward, with 12 rays, 8 of which are branched. Caudal fin deeply cleft, with the upper lobe a little longer than the head. Upper and lateral parts blackish-brown.

Gaboon, collected by R. B. N. Walker, Esq. One specimen, 290 millim. long.

This species is extremely similar to the type of *Ch. furcatus*, with which it agrees singularly well in regard to the disposition of the teeth on the palate, and the form and formation of the snout and mouth; but its body is considerably stouter and shorter, the dorsal fin is less elevated, the adipose longer. The differences may be epitomized thus:

Ch. furcatus.	*Ch. persimilis.*
Height of body one sixth;	one fifth.
Length of the head about one fourth;	about one third.
Base of dorsal fin = two fifths of distance between dorsal fins;	one half.
Dorsal spine less than length of head without snout;	equal to that length.
Base of adipose fin much shorter than that of dorsal;	rather shorter.
Intermaxillary band of teeth rounded at each end;	tapering.

CHRYSICHTHYS KINGSLEYÆ, sp. n. (Plate XLV. fig. A.)

The height of the body is two ninths of the total length (without caudal), the length of the head a little less than one third. The depth of the caudal peduncle is contained $1\frac{2}{3}$ times in its length. Head a little broader than high, its greatest depth being contained $1\frac{2}{3}$ times in its length; its upper parts are covered with skin; occipital process rather longer than the basal bone of the dorsal spine. Snout rather long, somewhat contracted in front, with the upper profile descending in a gentle curve; its length is contained $2\frac{2}{3}$ times in that of the head. Mouth rather wide, not extending to the middle of the distance between eye and nostril, wider than the distance between the eyes. Nasal barbels small

and short, about half as long as the eye. Maxillary barbels reaching to, outer mandibulary barbels not reaching to, the gill-opening when laid backward. Inner mandibulary barbels inserted in a nearly straight line with the outer ones, their roots being about half a diameter of the eye distant from each other. The teeth on the palate occupy vomer and palatine bones and are

Fig. 8.

Chrysichthys kingsleyæ. Upper and lower teeth.

disposed in two elongated patches on each side. The band of intermaxillary teeth is obliquely truncated at its lateral extremity, and two thirds as long as broad; *the length of the mandibulary band of teeth is one fourth of that of the head.* The width of the bony interorbital space is three fourths of the diameter of the eye, which is one fourth of the length of the head. Dorsal fin not elevated; the length of its base is one half of its distance from the adipose fin, the base of which is less than that of the dorsal. Dorsal spine shorter than the head without snout, equal in length to the pectoral spine, smooth in front, serrated behind. Anal fin just reaching the caudal, when laid backward, with 12 rays, 8 of which are branched. Caudal fin deeply cleft, with the upper lobe equal in length to the head. Upper parts dark with bluish tinge, sides and abdomen silvery.

River Ogowe; 225 millim. long.

This species is very closely allied to *Ch. persimilis*, and I have long hesitated before distinguishing it. In fact, it formed part of Miss Kingsley's collection, which I described in 1896; but, unwilling at that time to establish a species on apparently insufficient ground, I put it aside for future consideration. The principal difference from *Ch. persimilis* is that the cleft of the mouth does not extend equally far backward, and that the mandibulary band of teeth is very much shorter, indicating a proportionally shorter mandible. Unfortunately, we do not know from which of the Gaboon rivers *Ch. persimilis* was obtained.

CHRYSICHTHYS CAMARONENSIS, sp. n. (Plate XLIV.)

The height of the body is contained $4\frac{2}{3}$ times in the total length (without caudal), the length of the head $3\frac{1}{4}$ times. Caudal peduncle two thirds as high as long. Head broader than high, its greatest depth being contained $1\frac{2}{3}$ times in its length. The granu-

lations on its upper surface are covered by a thin skin. Occipital process about as long as the basal bone of the dorsal spine, both meeting in the middle of the nape. Snout very long, contained $2\frac{1}{3}$ times in the length of the head, broad, depressed, with the upper profile straight, and with the upper jaw much projecting beyond the lower. Mouth of moderate width, rather less than the distance between the eyes. Nasal barbels nearly as long as the eye; maxillary barbels extending to the margin of the præoperculum, outer mandibulary not reaching the gill-opening. Inner mandibulary barbels nearly in a straight line with the outer, and two thirds of the diameter of the eye distant from each other. The vomerine teeth are disposed on each side in two rather broad continuous patches, the halves being separated in front by a toothless space; the palatine bones are armed with a narrower band-like patch. Intermaxillary band narrowed outward, each half not quite twice as broad as long. The width of the bony interorbital space exceeds that of the orbit, which is contained $2\frac{2}{3}$ times in the length of the snout, and is one sixth of that of the head. Dorsal fin not elevated; its base is two fifths of its distance from the adipose, and double the length of the base of the latter fin. Dorsal spine as long as the head without snout, rather longer than the pectoral spine, smooth in front, and feebly denticulated behind. Anal fin reaching the caudal, when laid backward, with 15 rays, 10 of which are branched, the last split to the base, the first quite rudimentary. Caudal deeply cleft, the upper lobe a little longer than the head. Upper and lateral parts brownish, lower white.

Camaroons (Nat. Hist. Mus. 71.11.20.21). Length 600 millim.

Intermediate between *Ch. cranchii* and *Ch. nigrodigitatus*.

Eutropius congensis (Leach).

Two specimens from the Prah River. The anal fin of one with 56, of the other with 59 rays. Feeds largely on macrurous crustaceans.

Barbus trispilus (Bleek.).

Puntius (*Barbodes*) *trispilus*, Bleek. Mém. Soc. Holl. Haarlem, 1862, p. 113, tab. 23. fig. 3.

Two specimens from the Kotchwah River, 27 and 76 millim. long.

Relying on Bleeker's description alone, I should have been hardly justified in referring our specimens to his species. He describes it as a large-eyed species, with the eye longer than the snout, the diameter being one third, or a little less than one third, of the length of the head, and equal to, or a little less than, the length of the postorbital portion. His specimens measured from 72 to 110 millim.; thus his smaller specimen was almost the same size as our larger one. Nevertheless, I find the eye to be conspicuously smaller, viz., two sevenths of the length of the head and two thirds of that of the postorbital portion. Even our very

young specimen agrees better with these proportions than with those given by Bleeker. On the other hand, in the figure by which he illustrates his description, the eye seems to have been represented of too small a size.

HAPLOCHILUS INFRAFASCIATUS Gthr.

Several immature specimens from the Kakum River.

ALESTES LONGIPINNIS Gthr.

Is apparently common in the Kotchwah River.

PETERSIUS OCCIDENTALIS, sp. n. (Plate XLV., fig. B.)

D. 10. A. 21–24. L. lat. 25. L. transv. 4/3.

The height of the body is contained 3 times, the length of the head $3\frac{2}{3}$ times in the total (without caudal); eye large, longer than the snout, and contained $2\frac{2}{3}$ times in the length of the head; head, like body, strongly compressed, but the abdomen rounded in front of the ventrals. Dorsal fin higher than long, its first ray in the middle between the end of the snout and the root of the caudal. Anal of the mature male with the anterior rays somewhat enlarged, forming a projecting lobe. Caudal forked. There are two series of scales between the lateral line and ventral fin; the lateral line is anteriorly curved downward and runs towards the lower edge of the caudal peduncle, the perforations of the scales becoming indistinct. Silvery, with an indistinct, narrow, bluish band along the middle of the side and tail. Dorsal fin black in its anterior half, with a yellow band across the middle. This ornamental marking is most distinct in adult males, and very obsolete in immature specimens.

Six specimens, the longest 60 millim. long, from the Kotchwah River.

I have referred this fish to Hilgendorf's genus *Petersius* (S.B. Ges. ntrf. Fr. Berlin, 1894, p. 172), from the Kingani River in East Africa, although it does not quite agree with Hilgendorf's description of the dentition; this author also does not mention the partial disappearance of the lateral line on the tail. The teeth in the intermaxillary stand in two series, but the two series are quite separate, and the teeth of the two series are opposite to each other rather than alternate. I count six in the anterior, eight in the posterior, and as many in the mandibular series. The largest are in the posterior series, where they may be seven-pointed, the largest central cusps being laterally compressed. Those of the front series are more simple, but all seem to be tricuspid at least. No maxillary teeth.

MORMYRUS LONGICEPS Gthr.

Mormyrus longiceps, Günth. Ann. & Mag. N. H. 1867, xx. p. 116.

One specimen, from the Kotchwah River.

EXPLANATION OF THE PLATES.

PLATE XLI.

Chrysichthys büttikoferi, adult, p. 721, 4/9 nat. size. Dentition nat. size.

PLATE XLII.

A. *Chrysichthys büttikoferi*, juv., p. 723.
B. *Hemichromis terequamatus*, p. 717.

PLATE XLIII.

Chrysichthys persimilis, p. 727, 5/7 nat. size.

PLATE XLIV.

Chrysichthys camaronensis, p. 729, 1/3 nat. size. Dentition nat. size.

PLATE XLV.

A. *Chrysichthys kingsleyæ*, p. 728, 6/7 nat. size.
B. *Petersius occidentalis*, p. 731, with enlarged views of anal fin of male and female, and of dentition.

2. On a few Points in the Structure of Laborde's Shark (*Euprotomicrus labordii*). By ROBERT O. CUNNINGHAM, M.D., C.M.Z.S., Professor of Natural History, Queen's College, Belfast.

[Received April 28, 1899.]

An individual of this curious and little-known Elasmobranch having recently reached my hands, I have drawn up a few notes on its anatomy, which, though very imperfect and fragmentary, I venture to submit to the Zoological Society of London.

The specimen, which is a female, was, I am informed, one of several obtained by Captain F. R. Patey, of the ship 'Mowwan,' having been washed on board his vessel between 90° & 100° W. long. and in about the latitude of Cape Horn, and was presented to our Museum in Queen's College through the intervention of Mr. Adam T. Barklay of Belfast. As examples previously met have been recorded as inhabiting the Indian Ocean, the range of the species must be considerably more extensive than was formerly supposed—a not surprising circumstance when the wide distribution of many pelagic species of animals is taken into account. Two causes have combined to render the following description much less complete than I could have desired. In the first place, I have not felt warranted to carry out the dissection to such an extent as to render the specimen unavailable for Museum purposes, and, secondly, the condition of the viscera was unfortunately not such as to permit of detailed examination.

In respect of size my example does not materially differ from those

of which the dimensions are given in the British Museum Catalogue of Fishes (vol. viii. p. 428), being a little less than 10 inches in length measured from the extremity of the snout to the tip of the upper lobe of the caudal. The skin, as in the British Museum individuals, is, regarded as a whole, of a uniform brownish-black colour, but while the proximal portion of the azygos and paired fins are of the same tint, the distal present a marked contrast, being of a dull yellowish hue. There is a well-marked mid-dorsal and an equally well-marked mid-ventral groove, and on either side, not far from the dorsal surface, a rather deep lateral groove runs backward nearly to the base of the caudal. The area occupied by the five branchial apertures is about 8 mm. in length, the last of the slits being immediately in front of the base of the pectoral. The individual gill-slits are very small (only 2 millimetres in length), while the spiracles, on the other hand, are noteworthy for their large size; semicircular in outline, they measure 5 millimetres along the posterior border.

On the upper surface of the head are two well-marked curved longitudinal grooves, continuations forward of the lateral grooves already mentioned, connected by a transverse one situated immediately between the spiracles. Each of these grooves exhibits a series of pores (the openings of mucus-canals) which can be traced backward for some distance along the sides of the body. A row of pores further passes from the longitudinal groove of either side obliquely downward between the spiracle and the eye, and a second transverse row runs between the eye and the nostril to join a third row situated at right angles at some distance below the level of the eye. Additional pores more scattered in distribution occur in the skin covering the upper, and also in a less degree in that clothing the lower jaw.

The *nares* occupy a considerable area near the tip of the snout, being removed from the mouth by a considerable interval. Their upper portion is rounded, and they are continued ventrally in the form of elongated slits overlapped by a valve of skin. The *eyes* are large, measuring 9 mm. in antero-posterior diameter.

The *scales* are very small, communicating a minutely granular appearance to the skin, which is almost smooth, there being hardly any perceptible harshness to the feel when the fingers are passed along it from head to tail or *vice versâ*. Magnified a few diameters they appear in the form of slightly angular papillæ. When isolated, after boiling a fragment in caustic potash, they exhibit irregularly lozenge-shaped outlines and possess an elevated central and a depressed marginal area with a slightly toothed edge.

The aperture of the *mouth* at first sight appears much more extensive than it actually is, owing to a deep groove which runs backward from each angle. In the lower jaw only a single row of teeth are present. As noticed in Dr. Günther's excellent diagnostic description, they are of considerable size, triangular in outline and non-serrated. The teeth of the upper jaw are much smaller, conical, and are disposed in three series.

Unfortunately the abdominal cavity had not been opened before the fish was handed over to me, and in consequence of this, on removing the wall of the left side, I found that the viscera were by no means in such a satisfactory state of preservation as could have been desired, various of the organs being in a soft and decomposing condition. The *stomach*, which was attached to the dorsal wall of the abdomen by a broad peritoneal fold, possessed the ordinary siphonal form. The proximal portion was very capacious, thin-walled, and marked on the internal surface with numerous regularly disposed longitudinal rugæ. It was entirely empty of food. The distal moiety, comparatively long and narrow, was not clearly rounded off externally from the first portion of the intestinal tract, which was separated from the *colon* by a well-marked constriction succeeded by a short thick-walled dilatation. The *colon* possessed a typical transverse spiral valve. The short *rectum* had appended to it a well-marked rectal gland.

The *liver* consisted of a pair of apparently equal-sized large flattened lobes tapering to their pointed posterior ends. The *spleen*, of a dark greyish hue, was triangular in general form, with the apex pointing backward from the junction of the proximal and distal portions of the stomach and sent a long narrow lobe along the latter. The *pancreas* was of a whitish-yellow colour; in respect of outline it was long, slender, and band-like, and was provided with a long duct which opened into the intestine near its commencement.

The *ovaries*, very imperfectly preserved, formed a pair of elongated, somewhat lobulated bodies of a yellow colour, and the *oviducts* were of comparatively wide diameter.

Nothing could be made out with sufficient certainty as regards the nature of the other viscera.

3. On the Astræid Corals collected by the Author in the South Pacific. By J. Stanley Gardiner, M.A., F.Z.S., Fellow of Gonville and Caius College, Cambridge.

[Received April 26th, 1899.]

(Plates XLVI.–XLIX.)

The Corals of the family Astræidæ are represented in the collection made in the South Pacific by 115 specimens, which I have referred to 12 genera and 48 species. Of these I have described 6 species as new, and I have redescribed many of the known species, or added such characters as I have found of practical value for separating the different species of the several genera.

I have found the work very arduous on account of the very numerous synonyms existing, not only for species but also for genera. Martin Duncan's "Revision of the Madreporaria"

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

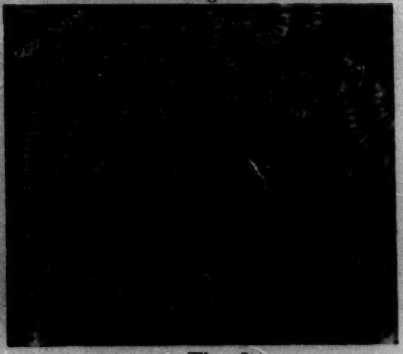


Fig. 6.

Photoprint by Bale & Danielsson Ltd

CORALS FROM THE SOUTH PACIFIC.

BRITISH
130099
MUSEUM

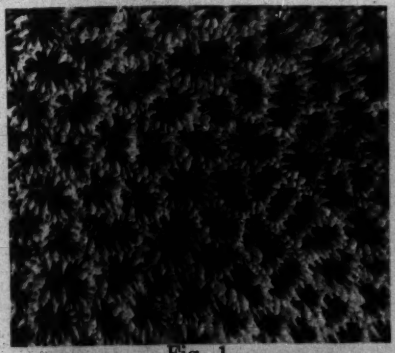


Fig. 1.

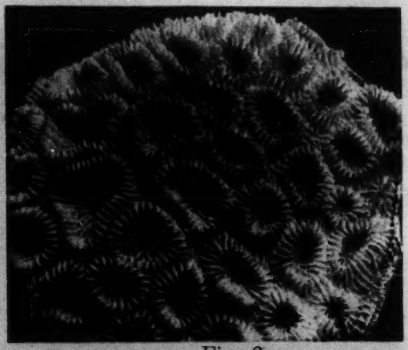


Fig. 2.

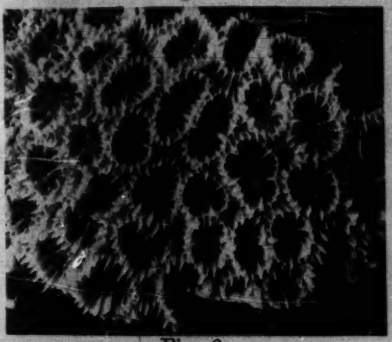


Fig. 3.

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Fig. 5.

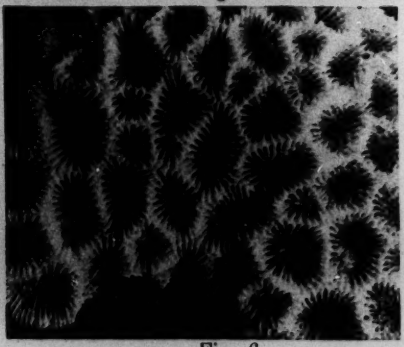

Fig. 6.

Photoprint by Bale & Danielsson Ltd

CORALS FROM THE SOUTH PACIFIC.

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Fig. 1.

Fig. 2.

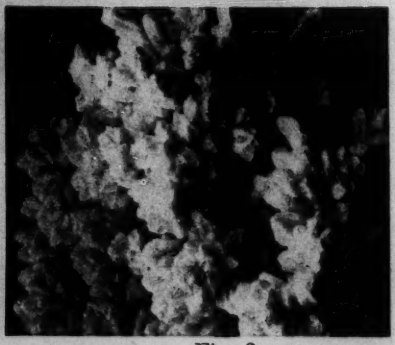

Fig. 3.

Photoprint by Bale & Danielsson Ltd

CORALS FROM THE SOUTH PACIFIC.

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Fig. 1.

Fig. 2.

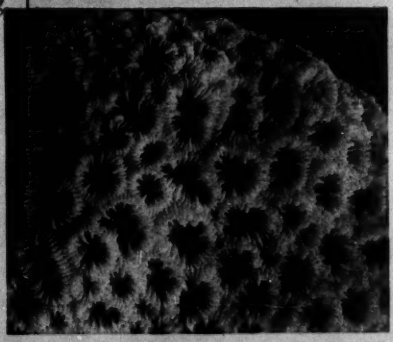

Fig. 3.

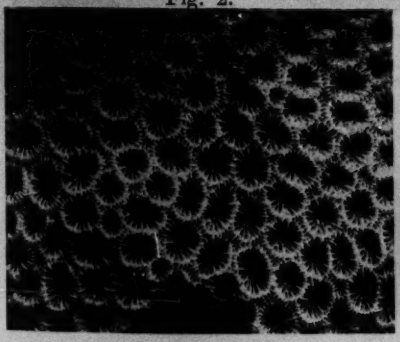

Fig. 4.

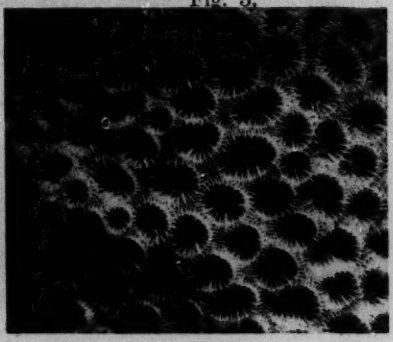

Fig. 5.

Photoprint by Bale & Danielsson Ltd.

CORALS FROM THE SOUTH PACIFIC.

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(Journ. Linn. Soc., Zool. xviii. p. 1, 1885) appears to be absolutely useless. The subfamilies and alliances are purely artificial, and even for the genera in a single alliance there is no distinct phraseology. Indeed, genera and alliances are constantly described in different but absolutely synonymous terms. That work, too, is not to be depended upon in so far as it refers to the authorities for the different genera. Indeed most of the errors of Milne-Edwards and Haime, corrected by Verrill, Klunzinger and others, appear in its pages. The Fungid and Perforate families are, however, often well described, and the work is a useful key to their genera.

Throughout the work I have made a liberal use of the Coral Gallery of the British Museum, and I have profited greatly by the advice of Prof. Jeffrey Bell and Mr. Bernard.

Genus Euphyllia.

Euphyllia, Dana, Zooph. p. 157 (1848).
Euphyllia, Milne-Edwards & Haime, Cor. ii. p. 191 (1857).

The characters separating the genera *Euphyllia* and *Caulastræa* do not seem to me of sufficient importance for the retention of the latter genus. The genus *Eusmilia*, further, is very doubtfully distinct. The characters separating the subfamilies *Astræidæ cæspitosæ* and *Astræidæ confluentes* of Martin Duncan, when practically examined, are found to be merely artificial and worthless.

1. Euphyllia glabrescens Chamisso.

Caryophyllia glabrescens, Chamisso & Eysenhardt, Nov. Act. Curios. Nat. x. p. 369 (1821).
Euphyllia glabrescens, Dana, Zooph. p. 163 (1848).
Euphyllia glabrescens, Milne-Edwards & Haime, Cor. ii. p. 192 (1857).

I have referred pieces from ten several colonies to this species, from which *Euphyllia gaimardi* (Milne-Edwards & Haime) is very doubtfully distinct.

The colony forms round clumps of corallites, which spring from the same stem, the branching being dichotomous. The branches vary greatly in length between their divisions, in one colony dividing every 12 mm., and in another having a length of nearly 40 mm. between the divisions. The whole mode of growth varies enormously, and appears to depend on the extent to which the bases and sides of the corallites are bored into and incrusted by different organisms, and doubtless also on the position of growth in respect to food-supply, &c.

The corallites naturally vary as well in respect to size, shape, and depth, being somewhat larger and always more distant, with deeper axial fossæ, in the more vigorously growing colonies. In one colony the corallites are about 4 mm. apart, and the separate calices (showing no trace of any division) vary up to 1·6 cm. in diameter, while in another colony they are ·9–1·5 cm. apart by

1·1–1·9 cm. in diameter. The costæ of the first two cycles of septa are distinct down the whole of the corallum, but those of the third cycle extend only for about 3 mm. and are very small.

The septa vary up to 2 mm. in exsertness and are entire, rounded at the top, sloping down rapidly to the axial fossa, which has no columella, being closed in below by trabeculæ from the septa.

In the living colony there are often two or three mouths, where there is no trace of more than one system in the corallum beneath. The polyps, when fully expanded, rise for about 3 cm. above the skeleton, but contract to less than 1 cm. in spirit; their tentacles are about 2 cm. long and not retrusible. The species is exceedingly difficult to preserve on account of the enormous quantity of mucus secreted, the least touch with the hand under water causing the complete obliteration of the stomodæum and peristome. The colour of the polyps varies from green-yellow to olive-brown, always markedly greener towards the stomodæa.

Rotuma; in pools of outer reef, very local in distribution, often forming large masses, 3–4 feet across.

I have been unable to determine the method by which the calices are divided, but in elongated corallites two of the larger septa sometimes fuse across the fossa and form a division. The thecal walls of the two sides then grow horizontally over the edges of these and fuse, flattening out to a breadth of about 2 mm. The young corallites next broaden out in a plane at right angles to the elongation of their parent corallite, themselves later to undergo a similar division.

Genus Mussa.

Mussa (pars), Oken, Lehrb. der Naturg. i. p. 73 (1815).
Mussa, Dana, Zooph. p. 173 (1848).
Mussa, Milne-Edwards & Haime, Cor. ii. p. 328 (1857).

Although I have examined a very large number of specimens of this genus both in the British and Cambridge Museums, I have completely failed to find any characters of good general specific value. Yet the specimens seemed to fall naturally into from eight to ten groups, none of which, however, were sharply marked off from their neighbours. The characters of the several septa, on which Dana very largely relied, do not seem to me to be of any great importance, and not uncommonly in the same colony septa corresponding to 4 or 5 of Dana's species can be found. The depth and shape of the corallites, too, depend very largely on the position of growth, *i. e.* whether the colony has plenty of room or is crowded with other organisms. Mainly depending on these characters Milne-Edwards and Haime described no less than thirteen species, most of which will indubitably be found to be synonyms.

Although I depend partially on the general form of growth, yet the more important characters seem to me to be—the extent and form of the epitheca, presence or absence and spinulation of costæ, and characters of the columella if present. The arrangement

of the endotheca in all is very similar, forming thin plates across the interseptal loculi, which may be arranged, according to the form of growth, in almost any position from horizontal to vertical.

1. Mussa cactus Dana.

Mussa cactus, Dana, Zooph. p. 178, pl. vii. fig. 1 (1848).

I have referred seven specimens to this species, with which two or three of those described by Milne-Edwards and Haime would also seem to be identical. All the specimens were obtained from the same locality, and in the colour of the living polyps conformed perfectly to Dana's figure and description:—"Disk green; inner tentacles bursiform, pearl-white, and brown at tip, outer a little elongate and brown." The broad pad of tissue in the contracted polyps round their edges is very well-marked in my spirit specimens as in Dana's figure. The corallites, however, tend to be more irregular in outline, and form in the centres of the colonies longer series than are represented by Dana.

The polyp extends for 1–1·5 cm. down the outside of the corallum, and below this there is a thin, incrusting epitheca. The costæ are marked solely by a few, upwardly directed, pointed spines about 1 mm. high and 3–4 mm. distant one from another. The columella is well marked, and formed of twisted lamellæ from the septal edges, without any distinct surface spinulation.

Rotuma; found only in certain reef-pools off Solkopi.

2. Mussa cristata Esper.

Madrepora cristata, Esper, Pflanz. i. p. 150, Madr. pl. xxvi. (1791).

Mussa cristata, Milne-Edwards & Haime, Cor. ii. p. 335 (1857).

I have referred four specimens to this species, which agree fairly well with the above descriptions. They do not bear, however, much resemblance to Esper's figure, the spinulation of the septa not being different from that of other members of the genus, and the costæ not being so marked, although without spines as in the figure. The polyps extend for 1·5–2 cm. down the outside of the corallum, and the ribbed appearance below their edges is in one specimen nearly as distinct as in Esper's figure. These ribs appear to be due to the retreating polyp laying down a thin epitheca behind it, which in places forms arches over the costæ, which themselves broaden out. The columella is well developed and of a spongy structure, with no spinulation on its surface.

Rotuma; boat-channel.

The living polyps are of a light olive-green colour.

3. Mussa multilobata Dana.

Mussa multilobata, Dana, Zooph. p. 181, pl. viii. fig. 2 (1848).

Mussa multilobata, Milne-Edwards & Haime, Cor. ii. p. 336 (1857).

This identification is, like that of *Mussa cactus*, largely based on

Dana's figure and description of the living animal:—"Animal chestnut-brown; disks long, sinuous and multilobate, bright green." Further, the tentacles are very short, of a darker brown colour and apparently in three rows. The corallum agrees with Dana's description so far as it goes, save that no importance can be placed on the septal teeth, and the calices are usually deeper than represented in Dana's section.

The epitheca cannot be distinguished. The costæ are marked only by spines, which are similar to those of *M. cactus*, but smaller and more distant. The columella is generally very small in the older and more completely circumscribed calices. It is formed merely by a few trabeculæ from the septal edges, and is covered with fine pointed spines.

Rotuma; very common with *M. cactus* in the same pools near Solkopi.

4. Mussa hemprichi Ehrenberg.

Manicina hemprichi, Ehrenberg, Coral. p. 101 (1834).

Mussa hemprichi, Klunzinger, Die Korall. des R. Meeres, iii. p. 8, pl. i. figs. 3 & 5 (1879).

Three specimens, which agree well with the forms identified by Klunzinger with this species of Ehrenberg.

Rotuma; reef. Wakaya, Fiji; reef.

5. Mussa sinuosa Lamarck.

Caryophyllia sinuosa, Lamarck, Hist. des Anim. s. Vert. ii. p. 229 (1816).

Mussa sinuosa, Milne-Edwards & Haime, Cor. ii. p. 333 (1857).

Wakaya, Fiji; reef. One specimen, doubtfully referred to this species.

Genus Symphyllia.

Symphyllia, Milne-Edwards & Haime. Comp. rend. de l'Acad. des Sc. xxvii. p. 491 (1848), and Cor. ii. p. 369 (1857).

The remarks made on the specific characters of the genus *Mussa* apply equally well to this genus, so far as the different modes of growth will allow.

1. Symphyllia sinuosa Quoy & Gaimard. (Plate XLVIII. fig. 1).

Mœandrina sinuosa, Quoy & Gaimard, Voy. de l'Astr., Zooph. p. 227, pl. viii. figs. 4–5 (1833).

Symphyllia sinuosa, Milne-Edwards & Haime, Ann. des Sc. Nat. ser. 3, x. pl. viii. fig. 7 (1848), and Cor. ii. p. 370 (1857).

There are two specimens of this well-characterized species. Septa of four cycles, the fourth incomplete, are present. Fresh calicinal centres are formed on the septa by the deposition of corallum on the floor and walls of the valleys; the septal edges then break up on further growth. Usually the calicinal centres

are joined by 3–5 septa, the inner ends of the original septa, and the septa on the walls of the valleys bend round towards them. The columella is formed of the twisted septal ends, and in the older calicular centres is often 4–5 mm. across and covered on the surface with fine, small spines.

Rotuma; boat-channel.

The species in the living condition is of a green colour, brown round the peristome. The colonies form great hemispherical masses, 2–3 feet across, and are very common in the outer half of the boat-channel. The species is noticeably resistant to the action of the sun, parts of the colonies at spring tides being uncovered for 2–3 hours. Massive colonies, too, which have died in the centre and been hollowed out are rare.

I have added a photo-figure (Plate XLVIII. fig. 1), as the differences in the septal orders, &c. are not clearly and accurately shown in the previous figures, nor do these figures correspond to the descriptions of their authors.

Genus Leptoria.

Leptoria, Milne-Edwards & Haime, Compt. rend. de l'Acad. des Sc. xxvii. p. 493 (1848), and Cor. ii. p. 405 (1857).

Two dried specimens, which appear to belong to the same two species as Dana found in Fiji. The genus is nowhere common, and indeed I found only one patch of each species.

1. Leptoria gracilis Dana.

Mœandrina gracilis, Dana, Zooph. p. 261, pl. xiv. fig. 6 (1848).
Leptoria gracilis, Milne-Edwards & Haime, Cor. ii. p. 407 (1857).
Leptoria gracilis, Klunzinger, Die Korall. des R. Meeres, iii. p. 13, pl. ii. fig. 5 (1879).

A single reef-specimen, having the general facies given by Dana. The septa are continuous over the winding thecal walls, in some places being about ·7 mm. exsert. The theca is apparently a pseudo-theca, formed by thickenings on the sides of the septa. The upper edges of the fused septa are almost horizontal over the theca, the edges towards the valleys being almost perpendicular. The edges of the septa are finely denticulate, and there are 14–16 septa in 1 cm. The columella is a thin imperforate plate in the valleys, and to it all the septa are fused. Its upper edge is covered with blunt, almost square lobes, about 7 in 1 cm. The interseptal loculi vary from 5–8 mm. in depth, and are closed in below by horizontal endothecal dissepiments.

Rotuma; outer reef.

2. Leptoria tenuis Dana.

Mœandrina tenuis, Dana, Zooph. p. 262, pl. xiv. fig. 7 (1848).
Leptoria tenuis, Milne-Edwards & Haime, Cor. ii. p. 407 (1857).

A single specimen, which corresponds very closely to Dana's

figure and the above description. The section of the theca, showing profile of septa, is the same as in Dana's figure, but the upper ends of the septa over the theca are generally more acute. The valleys vary greatly in depth and breadth, in accordance with the sinuosities of the surface of the colony. In breadth they vary up to 4 mm. by about the same in depth, being always markedly deeper than in my specimen of *Leptoria gracilis*. The septa on the sides of the straight valleys distinctly alternate in size, the smaller not reaching the columella. Where the valleys are more sinuous the arrangement, however, is not so regular, and often 3–5 contiguous septa meet the columella. The columella is very similar to that of *L. gracilis*, but the lobes on the surface are much lower, broader, and less marked.

Wakaya, Fiji; reef.

I am very doubtful whether this species is really distinct from *L. gracilis*, as the differences might be almost explained as due to different food-conditions in the two localities, as in the specimens of *Hydnophora microcona* from Funafuti and Wakaya; there are, however, no intermediate forms, nor can intermediate calices be seen on the specimens.

Genus Cœloria.

Cœloria, Milne-Edwards & Haime, Cor. ii. p. 411 (1857).

Cœloria, Duncan, Rev. Madrep., Jour. Linn. Soc. xviii. p. 89 (1884).

I have referred fifteen specimens to this genus, which is very doubtfully distinct from the genus *Mœandrina*. The chief difference, according to Martin Duncan, is that the columella in *Mœandrina* is "formed of masses of spongy tissue, well-developed," and in *Cœloria* "formed by trabeculæ from the edges of the septa, may be spongy." If this view is correct, it implies that *Mœandrina* has a true columella, formed, as in *Astroides calycularis*, by a deposit on the basal plate, while in *Cœloria* the columella is a secondary formation. Such a question can be settled only by a study of the development, but in the adult colonies there does not appear to be any real difference between the columella of the two genera, except such as would necessarily follow from the rather deeper, less sinuous, and thinner-walled valleys in *Cœloria*.

The theca is formed in *Cœloria* by a thickening of the septal sides. This thickening in a single colony may be plate-like, or in the form of nodules joining the septa, later broadening and forming a continuous wall, or very narrow, the theca in this case being formed mainly by a deposit of corallum on its upper edge. There is hence no reason, as Duncan has supposed (Jour. Linn. Soc., Zool. xvii. p. 363, 1884), for the separation of the species *C. pachychila* Ehrenberg as the type of a new genus.

The genus is very abundant on the lagoon-shoals at Funafuti, where it forms large, spreading masses, which vary in colour from brown to green. It is also found sparingly on the leeward reefs at

Funafuti and Rotuma, but it cannot apparently withstand the force of heavy breakers.

The specimens belong to five species, of which three were described by Milne-Edwards and Haime without figures. Carefully comparing all Milne-Edwards and Haime's descriptions of the species of the genus, and further comparing them with Ellis and Solander's, Esper's, and Dana's descriptions and figures, I have no doubt but that the specimens really belong to the species described by those authors. I have described one species as new under the name of *C. edwardsi*. This species is closely related to *C. bottai*, which has been probably correctly identified by Klunzinger with *C. arabica* var. *leptochila* Ehrenberg. From Klunzinger's description of this species, however, the characters of *C. edwardsi* would appear to be of good specific value.

1. Cœloria dædalea Ellis & Solander. (Plate XLVI. figs. 1, 2.)

Madrepora dædalea, Ellis & Solander, Zooph. p. 163, pl. xlvi. (1786).

Madrepora dædalea, Esper, Forts. Pflanz. i. p. 63, pl. lvii. fig. 1 (1797).

Cœloria dædalea, Milne-Edwards & Haime, Cor. ii. p. 416 (1857).

I have referred four specimens to this species, which vary very much among themselves, but yet present certain common features.

The colony forms large hemispherical masses, which die in the centre while continuing to grow at the periphery. The calices in the centre of such a mass are generally circumscribed, while near the periphery they form series often 3–4 cm. long. The growing edge is generally thick, and the under surface is covered by a thick, concentrically-marked epitheca.

The theca appears to be formed by thickening on the septal sides, and hence possesses a very ragged upper edge. The calicular walls are at first thin plates, formed by the fused thecæ, but, if the growth of the colony is slow, may thicken enormously by a deposition within the calices of vesicular corallum.

The septa belong to three cycles, of which the primaries and secondaries are nearly equal and fuse with the columella; the tertiaries are thin, narrow, and often wanting. There are 10–13 septa present in 1 cm. in the serial calices. The primaries and secondaries are continuous over the theca between the valleys, and are commonly about 1 mm. exsert. Generally the septa are thin, with ragged edges; their outlines vary enormously, but in section, between series, the larger septa are seen to form broad arches over the theca, with almost vertical edges, abruptly broadening towards the fossæ. The columella increases in size with the thickness of the theca, and is formed by the swollen septal edges and by trabeculæ from the septa, the whole forming an almost imperforate plate in the base of the valleys.

Rotuma; common in the boat-channel, where it forms large

spreading masses, 3–5 feet in diameter, small colonies only being found on the reef. Specimens *a*, *b*, *c*, and *d*.

The specimen "*a*" is a small hemispherical colony from the boat-channel, 7 cm. across by 5 cm. high. Its calices are generally circumscribed, the longest series being 2 cm. The theca is very thin, except in a few calices near one edge, and the columella is represented only by a few spines in the valleys. Breadth of the valleys 5 mm.; depth of same 4–5 mm. Septa, 10 in 1 cm.; tertiaries seldom present.

"*b*" is the peripheral growing-part of a large mass from the boat-channel, of which the greater part has been killed. The calices are seldom circumscribed, and the series vary up to 5 cm. in length. The theca is very thin, and the columella is very small, with a few spines on its surface. Breadth of the valleys 5 mm.; depth of same 4–5 mm. Septa, 12–13 in 1 cm. (Plate XLVI. fig. 1.)

"*c*" is a small colony, similar and nearly equal in size to "*a*," from the edge of the reef. The calices form convoluted series about 2 cm. long. The theca is commonly about 1·5 mm. thick, and the columella is often of the same breadth, being formed of coarse trabeculæ. Breadth of the valleys 6–7 mm.; depth of same 4 mm. Septa, 11 in 1 cm.

"*d*" is a colony 12 cm. long by 6 cm. broad by 5 cm. high, from the reef-flat. The calices generally form linear series up to 3 cm. long. The theca is 1–3 mm. in thickness, and the columella is about 1·5 mm. broad, formed of almost spongy trabeculæ. Breadth of the valleys 6–7 mm.; depth of same 5–6 mm. Septa, 11–12 in 1 cm. (Plate XLVI. fig. 2.)

2. Cœloria sinensis Milne-Edwards & Haime. (Plate XLVI. fig. 3.)

Astroria sinensis, Milne-Edwards & Haime, Ann. des Sc. Nat. sér. 3, xi. p. 298 (1849).

Cœloria sinensis, Milne-Edwards & Haime, Cor. ii. p. 416 (1857).

This species has the same mode of growth as *C. dædalea*, but may be distinguished from it by its thinner and more perfect theca and smaller dimensions. The calices vary in a similar manner to those of *C. dædalea*. The septa are very fine, seldom more than 1 mm. exsert, almost flat-topped, with vertical edges and fine denticulations. Three cycles of septa are present, of which the primary and secondary fuse with the columella. The latter is feebly developed, covered on the surface with a row of small, fine, irregular spines, and formed by fine trabeculæ from the septal edges, never forming a plate as in *C. dædalea*.

Breadth of the valleys 4–5 mm.; depth of the same 3–4·5 mm. Septa, 13–15 in 1 cm.

Funafuti; two specimens—the one a round mass, 16 cm. in diameter, with narrow much-eroded stem, obtained by the use of Priestman's grab from 7 fathoms, outside the reef, and the other the edge of a spreading mass from a lagoon-reef.

3. Cœloria astræiformis Milne-Edwards & Haime. (Plate XLVI. fig. 4.)

Astroria astræiformis, Milne-Edwards & Haime, Ann. des Sc. Nat. sér. 3, xi. p. 299 (1849).

Cœloria astræiformis, Milne-Edwards & Haime, Cor. ii. p. 417 (1857).

I have, with great hesitation, referred four specimens to this exceedingly ill-characterized species.

The colonies have the same form of growth as the two preceding species, but I never found them in such large masses. The calices are usually circumscribed, seldom forming valleys more than 1·5 cm. long. The theca is very thin and almost perfect. The third cycle of septa is nearly complete, but narrow, not reaching the columella. The primary and secondary septa are very thin, and hence appear somewhat distant; they are seldom more than ·5 mm. exsert, and are narrow above, increasing abruptly at the level of the columella. The columella is formed by twisted lamellate trabeculæ from the septal edges, and varies considerably in size. It is always distinct in section, and ends above in a few fine spines.

Breadth of the valleys 4–5 mm.; depth of the same 3–4 mm. Septa, 11–12 in 1 cm.

Funafuti; lagoon, two specimens. Wakaya, Fiji; reef, two specimens.

The corallum in all its different parts is rather coarser in the Wakayan specimens. In the smaller, a mere fragment from the extreme edge of the reef, some of the calices are 6 mm. broad and 5 mm. deep.

4. Cœloria esperi Milne-Edwards & Haime. (Plate XLVI. fig. 5.)

Madrepora dædalea (pars), Esper, Forts. Pflanz. i. p. 63, pl. lvii. fig. 2 (1797).

Astroria esperi, Milne-Edwards & Haime, Ann. des Sc. Nat. sér. 3, xi. p. 298 (1849).

Cœloria esperi, Milne-Edwards & Haime, Cor. ii. p. 417 (1857).

I am very doubtful whether this species is really distinct from *C. dædalea*, but yet, as my specimen (a dome-shaped mass 14 by 11 cm. by 7 cm. high) agrees almost perfectly with the above descriptions and exhibits little variety over its surface, I have retained the species.

Besides the differences from *C. dædalea* given in the above references, my specimen shows the following:—Epitheca of the same character, but thin and imperfect. Longest series 1·7 cm. Theca quite perfect. Septa seldom more than 1·5 mm. exsert, sloping more gradually, and with long spiniform teeth for 1–2 mm. above the columella. Columella less reduced, with no marked spines on its surface.

Breadth of the valleys 5·5–6·5 mm.; depth of the same 5 mm. Septa, 13–15 in 1 cm.

Rotuma; loc. incert.

5. Coeloria edwardsi, n. sp. (Plate XLVI. fig. 6.)

The corallum has the same general mode of growth as in *C. dædalea*, but appears primarily to form low, almost flat, spreading masses. The calices are seldom circumscribed, but form long valleys, which are generally sinuous in the centre of the mass, but towards the periphery are almost straight, radiating from the centre and occasionally branching. The epitheca is distinct, but thin and imperfect, with no concentric markings.

The theca varies little in thickness, being at the level of the columella about 1 mm. in breadth. It is formed of dense corallum, and grows rather by the deposition of corallum on its upper edge than by thickenings of the septal sides. The septa are very regular, uniform in size, and rather thick, falling into two cycles, the tertiaries being seldom represented. They are continuous over the walls between the serial calices, being uniformly about 1 mm. exsert. The upper edges of the septa above the theca are very uniform, from 2–3 mm. broad, and nearly horizontal; the edges then slope abruptly to the columella on each side, and large teeth are absent.

The columella is always distinct in the valleys, about 1 mm. broad. From the surface it looks like an irregular broad row of low spines, but in section is seen to be formed by fine filamentous trabeculæ from the septal edges. The interseptal loculi are very deep, endothecal dissepiments being seldom found within 1·2 cm. of the surface of the colony.

Breadth of the valleys 5–6 mm., usually 5 in 2·7 cm.; depth of the same, from the surface of the columella to the upper edges of the highest septa, 3–4 mm., often less near the edge of the colony. Septa, 11–12 in 1 cm. (Pl. XLVI. fig. 6.)

Rotuma; reef (?). Funafuti; lagoon-shoal.

The Rotuma specimen is a flat colony, 19 by 15·5 cm., about 6 cm. thick in the centre, gradually thinning towards the exterior. The Funafuti specimen is the edge of a mass 6 cm. thick, the central part of which was killed and overgrown by sponges; it hence does not exhibit the same regular arrangement of the valleys, and its septa also are rather thinner.

Genus Hydnophora.

Hydnophora, Milne-Edwards & Haime, Cor. ii. p. 418 (1857).

1. Hydnophora microcona Lamarck.

Monticularia microconos, Lamarck, Hist. des Anim. s. Vert. ii. p. 251 (1816).

Hydnophora microcona, Milne-Edwards & Haime, Cor. ii. p. 423 (1857).

Hydnophora microcona, Klunzinger, Die Korall. des R. Meeres, iii. p. 21, pl. iii. fig. 1 (1879).

I found this species to be by far the most abundant coral

growing on the lagoon-shoals at Funafuti; I did not, however, find it ever on the reef itself in that locality. In Fiji it is very common, growing at Wakaya both in the lagoon and on the leeward reefs.

The monticules of the Funafuti specimens are about 2·5 mm. distant from one another and 2 mm. high. On a Wakayan specimen from the lagoon they are 3–3·5 mm. distant and 2·5–3 mm. high, and on one from the reef 3–4·5 mm. distant and 3–4 mm. high. The differences between the latter specimen and the Funafuti specimens are so striking that at first sight they would appear to belong to distinct species. The variations are probably, however, due to absence of sand and mud, together with a more abundant food-supply on the reef at Wakaya. The lagoon-shoals of Funafuti are but sparingly covered with corals, whereas the whole reef to leeward of Wakaya is in many places covered with very luxuriantly-growing Madreporaria, *Millepora*, *Heliopora*, and *Tubipora* to within about 15 yards of the breakers.

The species forms large hemispherical masses, which commonly, as in *Porites*, die in the centre and are hollowed out, continuing to grow at the periphery. The monticules of the upper surface of an overhanging mass are somewhat pointed, while those of the lower surface are often flattened and very massive.

Funafuti; Wakaya, Fiji; Rotuma (spirit-specimens only).

2. Hydnophora lobata Lamarck. (Plate XLVIII. fig. 2.)

Monticularia lobata, Lamarck, Hist. des Anim. s. Vert. ii. p. 250 (1816).

Hydnophora lobata, Milne-Edwards & Haime, Cor. ii. p. 421 (1860).

One small specimen, which corresponds fairly well with the descriptions. It is a bifid lobe apparently torn off from a large massive colony. The monticules vary up to 7 mm. in length, and are from 2·5 to 5 mm. distant from one another and 3–5 mm. high. On the opposite sides of the valleys thick and broad septa alternate with thin and narrow. The broad septa apparently bifurcate and meet one another, fusing in the centre of the valleys; the large septa of one monticule lie then opposite to the small septa of the neighbouring monticules. The sides of the septa are granular and their edges are entire, save that the large septa have conspicuous vertical teeth where they bifurcate. The interseptal loculi vary up to 8 mm. in depth, and are closed below by horizontal partitions of endotheca.

Funafuti; 20 fathoms outside the reef.

3. Hydnophora exesa Pallas. (Plate XLVIII. fig. 3.)

Madrepora exesa, Pallas, Elench. Zooph. p. 290 (1766).

Hydnophora demidovii, Fischer, Mus. Demidoff, iii. p. 295, pl. iv. (1818).

Monticularia polygonata, Lamarck, Hist. des Anim. s. Vert. ii. p. 250 (1816).

Hydnophora exesa, *H. demidoffi*, and *H. polygonata*, Milne-Edwards & Haime, Cor. ii. pp. 420–422 (1857) (which see for other earlier references).

Milne-Edwards and Haime stated their opinion that the three species above mentioned would be found to be different stages of growth of one species. My specimen, on which I venture to propose the absorption of *H. demidovii* and *H. polygonata*, is a colony 13 by 11 cm. across and 8 cm. high. The underpart is dead, but the upper parts have sent out over it a thin growing edge, free in places for 2–3 cm. The upper surface is a mass of low anastomosing branches and lobes, varying from 7 mm. to 2·5 cm. in diameter, of nearly all the same height, dead in three places, where they had apparently reached the surface and become exposed to the sun at low tide.

The thin growing-edge is very fine, and its monticules have the general character of those given by Milne-Edwards and Haime for *H. exesa*, save only that, owing to the irregular surface over which the edge is growing, the valleys are seldom more than 4 mm. broad. The under surface is similar to that described for *H. demidoffi*, but the epitheca is in many places thick and well-marked. The length of the monticules on the lobes varies from 2 to 7 mm., being commonly greater on the larger and more central lobes. The monticules vary up to 6 mm. from one another, and up to 7 mm. in height.

Large and small septa alternate one with another, the large alone fusing in the centre of the valleys. The septa are not so thick, and are nearer to one another than in *H. lobata*; their edges, too, are rougher, and have no conspicuous teeth as in that species. The calicinal centres are not recognizable on the lobes, but on the thin growing-edge are fairly distinct. (Pl. XLVIII. fig. 3.)

Funafuti; outer reef.

Quelch distinguished a species, *H. tenella*, in his 'Challenger' Report, from *H. exesa* and *H. demidoffi* mainly by its mode of growth. I have already pointed out the great differences between the Wakayan reef-specimens of *H. microcona* and the Funafuti lagoon-specimens, and it seems to me to be probable that this is a case of a new species having been described when simply different conditions prevailed, causing different rates of growth. Whether the specimen above referred to *H. exesa* is really that species or *H. polygonata*, there seems to be no doubt but that *H. tenella* is only a synonym of *H. exesa*.

Genus GONIASTRÆA.

Goniastræa, Milne-Edwards & Haime, Compt. rend. de l'Acad. des Sc. xxvii. p. 495 (1849), and Cor. ii. p. 444 (1857).

This genus is easily distinguishable from *Astræa* by the possession of distinct pali. These are joined at first to the septal edges by trabeculæ, but later the connection becomes a distinct plate, so that they appear in section like thickenings of the septal edges.

1. GONIASTRÆA EXIMIA Dana.

Astræa eximia, Dana, Zooph. p. 242, pl. xiii. fig. 4 (1848).
Goniastræa eximia, Milne-Edwards & Haime, Cor. ii. p. 448 (1857).

The corallum of this species forms large irregularly-convex masses, which have thin spreading edges, covered underneath by a well-developed epitheca.

Three orders of septa are complete, and the fourth nearly so. Of these, two orders typically have pali, forming a well-marked crown round the axial fossa. The number of pali, however, varies greatly, in some colonies averaging in the larger calices 10–11, and in others 12–13. Some, too, of the tertiary septa in the largest calices project to the axial fossa, and have distinct paliform lobes. There is a true, finely trabeculate columella, about 1 mm. broad, situated about 2 mm. below the pali, which themselves are about 1 mm. below the edge of the calice.

The larger calices are 3–4·5 mm. in diameter. The walls are very thin, formed by two completely-fused thecæ. The septa are scarcely exsert, and are not generally continuous from calice to calice. Usually the primary septa in one calice lie opposite to the tertiary or quaternary septa in a neighbouring calice, not opposite to primary or secondary septa.

Rotuma; reef, three specimens. Wakaya, Fiji; reef, two specimens.

2. GONIASTRÆA SOLIDA Blainville.

Dipsastræa solida, Blainville, Dict. t. lx. p. 338 (1830).
Goniastræa solida, Milne-Edwards & Haime, Cor. ii. p. 444 (1857).

A single small specimen from the Rotuma reef, conforming closely to the above descriptions.

Genus ASTRÆA.

Astrea, Lamarck, Syst. des Anim. s. Vert. p. 371 (1801).
Astræa, Dana, Zooph. p. 200 (1848).
Favia, Milne-Edwards & Haime, Cor. ii. p. 426 (1857).
Astræa, Quelch, 'Challenger' Report on Reef Corals, p. 96 (1886).

Corals of this genus were among the most abundant found both at Funafuti and Rotuma. They do not occur generally near the rim of a reef, where it is exposed to the open sea, but are often found on the reef-flat behind. Their favourite position, however, is on shoals—preferably near a passage—in the comparatively quiet water of the lagoon.

Milne-Edwards and Haime enumerate 44 species of the genus. Of these species Dana's descriptions are by far the best, as the main characters on which the species are based are always indicated and figures of all are given. Valenciennes's MSS. descriptions are absolutely useless; and many of the species described by

Milne-Edwards and Haime are almost certainly varieties of previously described species, due to position of growth.

It is noticeable that there are in the collection no two specimens exactly alike in their calices, no two, indeed, which do not give as good specific differences as many of the species described by Milne-Edwards and Haime. Indeed without drawings (or preferably photo-plates) descriptions are absolutely useless. I have described one specimen as new; it differs markedly, in the characters of its septa, in its distinct calicular rim (formed by the theca), and in the deep sulci, from all previously described species.

1. Astræa denticulata Ellis & Solander. (Plate XLVII. fig. 1.)

Madrepora denticulata, Ellis & Solander, Zooph. p. 166, pl. xiv. fig. 1 (1786).

Favia denticulata, Milne-Edwards & Haime, Cor. ii. p. 428 (1857).

There are two specimens of this well-known species, which is very common on the lagoon reefs and on the outer reefs to leeward at Funafuti. The thecæ of neighbouring calices are generally completely fused, forming thin dividing walls. In places, however, the thecæ are distinct at the surface and about 1 mm. distant one from another. In the more vigorously growing portions of the colonies the calices are deep, the septa slope directly down to the axial fossa without any distinct paliform lobes, and the columella is very small and inconspicuous. On the undersides and least vigorously growing portions of the colonies the calices are shallow, the septa have broad, paliform lobes, and the columella is a distinct trabeculated mass.

Funafuti; lagoon and outer reefs.

2. Astræa fragilis Dana.

Astræa fragilis, Dana, Zooph. p. 230, pl. xii. fig. 2 (1848).

Two specimens, which agree closely with Dana's figures and description. The larger calices are about 9 mm. in breadth by 4–5 mm. in depth. Their dividing walls are 1–1·5 mm. broad and compact. The septa form three complete orders, the fourth being represented by about 6 septa. The primaries and secondaries are subequal and slightly thicker, broader and more exsert than the tertiaries. The septa are not usually continuous between the calices over the walls, which accordingly show commonly a distinct sulcus. In the Rotuma specimen the septa are thicker and more exsert, and the wall has a more distinct sulcus than in the Funafuti specimen, in which further the septa of the first three orders approach one another in size. The columella is generally distinct, being formed by very fine spongy trabeculæ.

Funafuti; lagoon. Rotuma; boat-channel.

3. Astræa pallida Dana.

Astræa pallida, Dana, Zooph. p. 224, pl. x. fig. 13 (1848).

Two specimens, corresponding closely to Dana's description and figures (except fig. 13 *b*, "cells in outline") and having living

polyps similarly coloured. The larger calices are 9–14 mm. in diameter by 5–7 mm. in depth. The dividing-walls vary from 1·5 to 2·5 mm. in breadth, and have always a well-defined sulcus. The septa form three complete orders, and there are sometimes a few septa of a fourth cycle. The primaries and secondaries are equal in size, about 2 mm. exsert, and have well-marked paliform lobes. By the fusion of trabeculæ from their septal edges, a well-defined oval columella is formed. The under surfaces of both specimens are covered by a distinct thin epitheca.

Rotuma; reef-flat and rim of reef.

The specimen from the reef-flat has its calices broader and shallower than the one from the rim. The paliform lobes in the same specimen are also much more distinct and form a marked crown round the columella, which is generally at least 2 mm. in diameter.

4. ASTRÆA OKENI Milne-Edwards & Haime. (Plate XLVII. fig. 2.)

Favia okeni, Milne-Edwards & Haime, Cor. ii. p. 430 (1857).

This species differs from the preceding in having broad dividing walls (2·5–4 mm.) between its calices with very distinct sulci. The corallites do not have any distinct raised rim, save that which is formed by the nearly equally exsert upper ends of the septa, of which there are three complete cycles. All the septa fuse with the columella, the tertiaries a little lower than the primaries and secondaries. All have distinct, bluntly angular teeth at their lower ends, but these do not in any way simulate pali. (Pl. XLVII. fig. 2.)

Rotuma; boat-channel.

5. ASTRÆA PUTEOLINA Dana.

Astræa puteolina, Dana, Zooph. p. 223, pl. xi. fig. 3 (1848).

A single flattened mass, the incrusting base of which has been eroded away. The mass is much incrusted by nullipores; when obtained, only the calices round the edges were alive. The specimen differs from those of *A. fragilis* in the collection in having larger calices, 11–13 mm. in diameter by 4·5–6·5 mm. in depth. There are three complete cycles of septa, of which two reach the columella. The walls are about 2 mm. thick, and the septa of neighbouring calices are often continuous over them, the sulcus being scarcely noticeable. The species is almost exactly an enlarged edition of *A. fragilis*, but the septa and corallum, even in the smallest calices (7 mm. in diameter), are much more massive.

Funafuti; lagoon shoals.

6. ASTRÆA LOBATA Milne-Edwards & Haime.

Favia lobata, Milne-Edwards & Haime, Cor. ii. p. 434 (1857).

Favia lobata, Klunzinger, Die Korall. des R. Meeres, iii. p. 31, pl. iii. fig. 9 (1879).

Two specimens, which conform closely to the above descriptions, and to some extent show the same features as the two specimens

represented in Klunzinger's figure. The large, distinct, primary septa are extremely characteristic.

Funafuti; dredged in the South Ship's Passage from 5 fathoms.

7. ASTRÆA ROTUMANA, n. sp. (Plate XLVII. fig. 3.)

The corallum forms large incrusting masses, covered underneath by a thin epitheca. The colony does not seem to increase much by fission and budding at the edge, which is very thick and costulated down to the epitheca.

The calices vary from 6 to 11 mm. in diameter by 4–6 mm. in depth to the top of the columella. The septa are usually rather thin, except in their exsert portions, and the interseptal loculi are wide and deep. In the largest calices two orders of septa are complete and there are commonly 8 or 10 septa of the third order. The primary septa are about 2·5 mm. exsert, and about 2 mm. broad at the level of the thecal rim. Lower down they broaden out, the edges still lower running almost horizontally into the columella, but giving off first each a blunt, vertical paliform tooth. In the smallest calices the primary septa alone join the columella, but in the larger calices often 3 or 4 of the secondary septa fuse with it as well. The latter may somewhat simulate the primaries, but the secondaries never attain the same exsertness nor are their paliform lobes well-marked. The tertiary septa are about 1 mm. exsert, and are very thin and narrow, being seldom more than 1·5 mm. broad.

The walls vary from 1·5 to 3 mm. in thickness, and the rims of the calices are about 1 mm. high. The septa are not continuous between the calices, so that the sulci are very conspicuous and deep. The columella is formed by fine, loosely joined trabeculæ from the septal edges, and in the larger calices, in which it is often 1–1·5 mm. broad, has a finely papillate surface. In the smaller calices the columella is often scarcely visible.

The interseptal loculi are open for about 1 cm., below which they are closed by nearly horizontal endothecal dissepiments, about 1 mm. distant from one another. The thecæ of neighbouring corallites are joined also by similar exothecal dissepiments. (Pl. XLVII. fig. 3.)

Rotuma; a single specimen, 13 cm. long by 1 cm. broad, part of an incrusting mass.

8. ASTRÆA AFFINIS, Milne-Edwards & Haime.

Favia affinis, Milne-Edwards & Haime, Cor. ii. p. 429 (1857).

I have referred a single specimen with 19 calices to the above species, as it differs from *A. denticulata* and agrees with the above species in the characters given by Milne-Edwards and Haime. The dividing walls of the specimen are as thick as in my specimens of *A. denticulata*, but the thickness varies enormously in all species of *Astræa*. My specimen is too small for any definite statement, but the two species will, I think, be found to be identical.

Wakaya, Fiji; outer reef.

Genus Orbicella.

Orbicella, Dana, Zooph. p. 205 (1848).

Heliastræa, Milne-Edwards & Haime, Cor. ii. p. 457 (1857).

Heliastræa, Duncan, Rev. Madrep., Journ. Linn. Soc., Zool. xviii. p. 104 (1885).

Plesiastræa, Milne-Edwards & Haime, Compt. rend. de l'Acad. des Sc. xxvii. p. 494 (1848), and Cor. ii. p. 489 (1857).

Plesiastræa, Duncan, Rev. Madrep., Journ. Linn. Soc., Zool. xviii. p. 107 (1885).

Leptastræa, Milne-Edwards & Haime, Compt. rend. de l'Acad. des Sc. xxvii. p. 494 (1848), and Cor. ii. p. 493 (1857).

Leptastræa, Duncan, Rev. Madrep., Journ. Linn. Soc., Zool. xviii. p. 119 (1885).

Orbicella and *Leptastræa*, Klunzinger, Die Korall. des R. Meeres, iii. pp. 43–50 (1879).

There are in my collection 20 specimens of this genus, in addition to which I have examined a very large number of colonies in the British and Cambridge Museums.

The genus *Plesiastræa* was separated from *Heliastræa* by Milne-Edwards and Haime in 1848, and stated to have well-developed pali before all the cycles of septa except the last, while the pali in *Heliastræa* are absent or rudimentary. In *Heliastræa acropora* the pali are exceedingly well-developed before all the cycles of septa except the last; while in *Plesiastræa versipora* the pali, although generally very distinct, are in some calices not recognizable.

Again, these two genera are stated to have their whole septal edges toothed, while *Leptastræa* has the upper edges of its septa entire and the lower edges toothed. This also is rather a question of degree, for in *Leptastræa solidior*, while the upper edges are generally almost entire, in some calices they are finely and in others very markedly toothed.

One of my specimens, too, of *Orbicella* (*Heliastræa*) *heliopora* presents calices which, examined separately as to the above characteristics, would be placed in all the three so-called genera. Indeed, any large colony of almost any species of these genera has calices intermediate between those of the other two genera.

Further, all these three genera have the same method of budding and plan of structure; and indeed, from the study of the hard parts alone, there is no valid reason to separate them. For the genus I have, following Klunzinger, employed the term *Orbicella*, as it has clearly the priority, being first used by Dana for a subgenus of *Astræa*.

The genus *Orbicella* would then be characterized as follows:—Corallites forming massive and incrusting colonies, sometimes growing out into lobes, but usually forming rounded masses, covered below by a distinct epitheca. Calices generally completely separate, with the edges more or less prominent, often elevated. Corallites joined together by exotheca only, the costæ never being continuous between calices, except where a young polyp has recently been budded off. Calices usually deep and closed in

below by a more or less developed columella, formed by trabeculæ from the septal edges. Interseptal loculi deep, closed below by transverse endothecal dissepiments. Septa usually somewhat exsert and well-developed, commonly at least two cycles fusing with the columella. Paliform lobes generally present and well-developed, usually recognizable at least in some parts of a colony. Costæ varying in development, generally distinct, but sometimes not recognizable in surface view. Exotheca usually well-developed, often completely filling in the space between the theca of neighbouring corallites. Increase by intercalicular gemmation over the costæ, where three or more calices meet, sometimes also by fissiparity.

1. Orbicella acropora Linnæus.

Madrepora acropora, Linnæus, Syst. Nat., edit. 12, p. 1276 (1767).

Madrepora acropora, Esper, Forts. Pflanz. i. p. 21, pl. xxxviii. (1797).

Heliastræa acropora, Milne-Edwards & Haime, Cor. ii. p. 477 (1857).

There are two specimens, both incrusting masses, which correspond closely to the above descriptions. The edges of the calices are free for about 1 mm. in height, while the calices are about 2 mm. deep to the top of the columella and in diameter vary up to 5 mm. The costæ and septa are as described by Milne-Edwards and Haime, but the smaller costæ are not usually present, and the septa which reach the columella—generally 9–12—have commonly a very distinct paliform lobe. Increase is usually by intercalicular gemmation, but in three calices of the larger specimen—10 by 6 cm.—fissiparity is occurring.

There are two specimens, the first as described above, but the second differing in having rather smaller calices, more delicate septa, and less distinct pali.

Rotuma; outer reef.

The appearance represented by Esper in the lower right calice of fig. 2 is due to a worm boring in the columella. It commonly occurs in many corals, and ultimately results in killing the polyp into which it grows.

2. Orbicella orion Dana.

Orbicella orion, Dana, Zooph. p. 720, pl. xiii. fig. 14 (1848).

A single lobe from the surface of a colony, which agrees closely with Dana's figures and descriptions so far as they go. The calices are more or less rounded, with distinct free edges, very little raised. There are three complete cycles of septa and a few septa of a fourth cycle are often distinguishable. Of these the primary septa are usually markedly larger and broader than the rest and have well-developed, blunt paliform lobes, which may be simulated by two or three septa of the second cycle. The

edges of all are rough without any distinct teeth. The columella is formed by very fine trabeculæ from the edges of the primary septa, and in the largest calices is usually about 1 mm. across. The endotheca forms transverse partitions—distant about ·5 mm. from one another—across the interseptal loculi.

Funafuti.

3. Orbicella wakayana, n. sp. (Plate XLIX. fig. 2.)

There are three specimens, which agree very closely with *O. annuligera* in its described characters, but have their calices seldom less than 3·5 mm. deep. They may possibly be identical with that species; but as my specimens have uniformly deep calices, with other corresponding differences, I have no option but to describe them as a new species.

The colonies form spreading and incrusting masses covered uniformly underneath by a distinct epitheca. The calices are round, and commonly 5–6 mm. in diameter by 3–4·5 mm. deep. They usually have a quite distinct rim, often as much as 2 mm. high, and are commonly about 2·5 mm. distant one from another.

The septa are 30–40 in number and cannot be divided into cycles. They are generally equally exsert, but usually about half reach the columella, while half are very narrow. A certain number of septa (6–10) are often somewhat broader at their upper ends and so may simulate a primary cycle. The costæ are subequal, and are not, except where budding has recently taken place, continuous between the calices, which are joined solely by exothecal trabeculæ. The septal edges are very finely spined, and the larger septa in some calices merge directly into the columella, but in others may have each a distinct, fine, paliform tooth, with its summit even 2 mm. above the columella. The latter is generally almost round, 1–2 mm. in diameter, and is formed by very fine, closely anastomosing trabeculæ from the septal edges.

In section, the thecæ of neighbouring calices are seen to be quite distinct one from another, the exotheca forming fine trabeculæ, never filling up the interthecal spaces. The interseptal loculi are deep—7–8 mm.—and closed in below by thin, nearly horizontal endothecal dissepiments, distant about 1 mm. one from another.

Wakaya, Fiji; three small specimens, all obtained close to the edge of the reef.

4. Orbicella versipora Lamarck.

Astrea versipora, Lamarck, Hist. des Anim. s. Vert. ii. p. 264 (1816).

Plesiastræa versipora, Milne-Edwards & Haime, Cor. ii. p. 490, pl. D 7. fig. 5 (1857).

A single specimen, closely resembling the above descriptions and a specimen so named in the British Museum. The species possesses well-marked crateriform calices, with free edges, joined only by

exotheca. The valleys between the calices are always distinct and usually about 3 mm. broad. They are not closed in below by a dense, smooth peritheca as represented in Milne-Edwards and Haime's figure, but at the bottom the costæ of neighbouring calices meet. The columella is situated about 1·5 mm. below the crown of paliform teeth, the whole calice being 4–5 mm. deep.

Rotuma; reef.

5. ORBICELLA CURTA Dana.

Orbicella curta, Dana, Zooph. p. 209, pl. x. fig. 3 (1846).

There is in this species always a distinct valley between the calices, but the interthecal spaces are often filled up with dense solid exotheca. The calices have typically 48 septa in four cycles, but usually the last cycle is incomplete. The first and second cycles meet the columella; the primaries are much coarser than the rest, ending above in broad (1·5 mm.), slightly more exsert edges, and below having generally small paliform teeth. The rest of the septa are very thin and equally exsert with finely toothed edges. The tertiaries often bend round and fuse with the secondaries before the latter join the columella; the quaternaries are always distinct but very narrow. The costæ are of equal thickness and meet in the valleys, but are not directly continuous between the calices. The columella is small and formed by twisted lamellæ from the septal edges, which have from the surface rather a papillate appearance.

The calices in my specimen are rather irregular and a few exhibit well-marked fissiparity. The largest are from 8–9 mm. in diameter by 5 mm. deep.

Funafuti; one specimen.

6. ORBICELLA CORONATA Dana.

Orbicella coronata, Dana, Zooph. p. 211, pl. x. fig. 4 (1848).

There is one specimen of this species, which possesses very markedly the specific characters given by Dana. The calices are crowded, but have nearly always distinct rims; the costæ, however, are sometimes continuous from calice to calice. The septa form three cycles, of which the primaries are considerably (1 mm.) more exsert than the secondaries and the latter than the tertiaries. The costæ also show similar differences. The primaries have almost horizontal upper edges, 2 mm. broad, and distinct, small, low, paliform teeth. A few of the secondaries may meet the columella, but generally they are little broader than the tertiaries. The sides of all the septa are coarsely granular and the edges of all end in fine, subequal spines. The columella is very small and formed by a few flat trabeculæ from the primary septa.

The calices vary up to about 8 mm. in diameter by 4 mm. deep. The primary septa are about 2 mm. exsert.

Funafuti; leeward reef.

7. Orbicella rotumana, n. sp. (Plate XLIX. fig. 3.)

The corallum is an incrusting mass, covered underneath by a thin, dense epitheca. The calices are crowded, but have nearly always a distinct rim, the costæ never being continuous between. The septa are nearly equally exsert and the costæ are subequal in size.

The septa form three complete cycles, and usually the greater number of septa of the fourth cycle are present. The primaries, as in *O. coronata* and *O. curta*, have broad (2 mm.), horizontal, upper edges and are provided with rather long paliform lobes, often rising for 2–2·5 mm. above the columella. A few of the secondary septa sometimes simulate the primaries, but usually they do not meet the columella. The tertiaries are always distinct, but the quaternaries are scarcely distinguishable within the calices All the septa are relatively thin (not differing greatly one from another in thickness) with smooth sides, and are often much fenestrated; their edges are covered with long, thin, pointed spines, which commonly increase considerably in length towards the base of the calice. The columella is very small, appearing in many calices to be little more than the fusion of the edges of the primary septa.

The calices are rather crowded and distorted, varying up to 9 mm. in diameter by 4–5 mm. in depth.

Rotuma; boat-channel (?). One specimen.

This species is very closely allied to *O. coronata* and *O. curta*. The calices of the three specimens of these species in my collection scarcely merge into one another in any way, nor did I find any intermediate forms in the British Museum. *O. rotumana* differs from *O. curta* in its distinct paliform lobes, long, spiny septal teeth, tertiary septa never fused to secondaries, and the latter often simulating the primaries. *O. coronata* differs from both in its much coarser and thicker septa, which seldom form more than three complete cycles.

8. Orbicella klunzingeri, n. sp.

Leptastræa ehrenbergana, Klunzinger, Die Korall. des R. Meeres, iii. p. 46, pl. vi. fig. 3 (1879).

There are two specimens, which undoubtedly belong to the species which has been excellently described and figured by Klunzinger under the name of *Leptastræa ehrenbergana*. This species cannot possibly be the species described by Milne-Edwards and Haime under that name, so that I propose to call it *O. klunzingeri*. As my specimens agree in nearly every respect with Klunzinger's description, there is no need for me to recapitulate the specific characters.

Klunzinger's figure shows considerable variation in the size of the calices. In my specimens on the highest points, nodules on the colony, some of the calices are 8–9 mm. in greatest width, while in some of the valleys they do not average more than 3 mm. In the latter position further the thecæ of neighbouring calices are completely fused, but the costæ are not continuous.

Funafuti and Rotuma.

9. Orbicella heliopora Lamarck. (Plate XLIX. fig. 4.)

Astræa heliopora, Lamarck, Hist. des Anim. s. Vert. ii. p. 263 (1816).

Heliastræa heliopora, Milne-Edwards & Haime, Cor. ii. p. 459 (1857).

Milne-Edwards and Haime have already given a full description of this species, with which two specimens in my collection very closely agree. There is a considerable amount of variation in my larger specimen, the thecæ of neighbouring calices being in some parts closely apposed, and in others 2–3 mm. apart with a very distinct valley between. The septa show a condition approaching that found in *O. coronata*, *O. curta*, and *O. rotumana*, the primaries being markedly broader at their upper edges than the secondaries. All the primaries and most of the secondaries meet the columella and are provided with paliform lobes.

In the smaller specimen, a young colony, the crateriform character of the calices is more marked and the calices are rather deeper, being often 4–5 mm.

Funafuti; leeward reef.

10. Orbicella solidior Milne-Edwards & Haime.

Astræa solidior, Milne-Edwards & Haime, Ann. des Sc. Nat. sér. 3, xii. p. 102 (1850).

Heliastræa solidior, Milne-Edwards & Haime, Cor. ii. p. 460 (1857).

Three specimens, which closely correspond to the descriptions. The calices in all the specimens have distinct low rims, separated by shallow valleys. The columella is always very dense and well marked, being formed by trabeculæ from all the septa of the first two cycles and some also of the third cycle. While the costæ are of equal size, the septa of the different cycles are quite distinct, those of lower cycles being more exsert, thicker, and broader than those of higher cycles. Paliform lobes are only found on the primaries and secondaries.

Funafuti; lagoon reefs.

11. Orbicella funafutensis, n. sp. (Plate XLIX. fig. 5.)

The corallum is a large incrusting mass covered underneath by a dense epitheca. The corallites are free at their edges—the thecæ being often 2–3 mm. distant—but there is no distinct valley between. The costæ are nearly of equal size and thin; they are joined on neighbouring corallites by exotheca and are never continuous.

The calices are generally round, but sometimes more or less oval, never polygonal. The septa form three complete cycles, and commonly in one half of each system two septa of a fourth cycle are found. The primary septa are recognizable in all the calices, being slightly thicker and broader at their upper edges than the rest, and having low, broad, blunt paliform teeth before they join

the columella. The secondary septa also join the columella, but never have marked paliform teeth. The tertiary septa are very narrow, except where two quaternary septa are present on either side. Both septa and costæ are relatively thin and are covered on their edges by low, blunt, subequal teeth. The columella is seldom more than 1 mm. across, and is formed by a few coarse trabeculæ from the primary septa.

The calices, when round, are seldom more than 7 mm. in diameter, but some of oval shape are 9 mm. long by 5 mm. broad. The depth of all is fairly constant, 3–4 mm.

Funafuti; leeward reef.

There are two specimens of this species, one of which is 14 by 9 cm. by 7 cm. high, and the other a small colony, 6 by 5 by 3 cm. high. The former is of a light structure throughout, but the latter is much denser, with the spaces between the thecæ and costæ completely filled up by exotheca.

Genus Prionastræa.

Prionastræa, Milne-Edwards & Haime, Comp. rend. de l'Acad. des Sc. xxvii. p. 495 (1848), and Cor. ii. p. 513 (1857).

Acanthastræa, Milne-Edwards & Haime, Comp. rend. de l'Acad. des Sc. xxvii. p. 495 (1848), and Cor. ii. p. 501 (1857).

The species described by Milne-Edwards and Haime under these two genera were practically separated solely by the septal teeth. These were said to be longest near the columella in *Prionastræa*, and shortest in the same position in *Acanthastræa*.

Martin Duncan, in his "Revision of the Families and Genera of the Madreporaria,"[1] added no new constant characters, but placed the two genera in different alliances, which he described in different but practically synonymous terms. In the specimen referred by me to *P. echinata*, while generally the septal teeth are longest over the walls, in some calices they are of nearly equal length and in a few absolutely longest near the columella. The opposite too is true of *P. abdita* and *P. purpurea*. I found also in specimens of both the so-called genera in the British Museum nearly every possible variety in arrangement of the septal teeth.

Although I had different species of this genus constantly under observation, both on the reef and in bottles, both by night and by day, it is noticeable that I never saw any polyps with well-marked tentacles. The peristome in all living polyps is quite distinct and smooth, while the external body-wall forms a thick pad round it. In *P. abdita* I observed short blunt processes of the body-wall round the peristome; but in the spirit-specimens in my collection there is no trace of these rudimentary tentacles, the whole peristome and body-wall being thrown into blunt rugæ between the attachments of the mesenteries.

[1] Journ. Linn. Soc., Zool. xviii. pp. 119 & 123 (1885).

The polyps of *P. abdita*, *P. purpurea*, and *P. fusco-viridis* are crowded with commensal zooxanthellæ, and from colonies of these species I succeeded in collecting a certain amount of oxygen[1]. These three species live on the extreme breaking edge of the reef and are exposed at spring-tides for 2 or 3 hours to the sun, though constantly wetted by the spray. They form also large spreading masses as deep as can be seen outside the reef.

1. PRIONASTRÆA ABDITA Ell. & Sol. (Plate XLVII. fig. 4.)

Madrepora abdita, Ellis & Solander, Zooph. p. 162, pl. l. fig. 2 (1786).

Prionastræa abdita, Milne-Edwards & Haime, Cor. ii. p. 514 (1857).

Astræa virens, Dana, Zooph. p. 228, pl. xi. fig. 8 (1848).

Prionastræa profundicella, Milne-Edwards & Haime, Ann. des Sc. Nat. sér. 3, xii. p. 131 (1850), and Cor. ii. p. 131 (1837).

I have referred six specimens to this species. All were obtained from the same position on the reef and had their polyps uniformly coloured olive-green. Of these the largest specimen (*a*) (Pl. XLVII. fig. 4) appears to be the edge of a massive colony which has been killed in the centre. The specimen is much thicker towards its upper edge, and here its surface is rather irregular, tending to form blunt lobes. The under surface, where visible, is covered with a thick epitheca.

Towards the upper edge and on the lobes the calices are more or less polygonal with extremely thin walls, and vary in size up to about 11 mm. in diameter by 8·5 mm. in depth. Towards the lower edge the walls of the calices are often 2–3 mm. broad, while the calices vary up to 15 mm. in breadth, but are seldom more than 6 mm. deep. The septa do not vary much in the different calices, from 30–40 generally being present. Of these about 18 are larger than the rest, subequal in size, and fuse with the columella. The septa are usually continuous from calice to calice over the walls, but are very narrow at their upper ends and only slightly exsert. All end at their edges in large, sharp, pointed teeth, which vary enormously, but commonly are much longer in the deeper calices, where the septa merge into the columella. In the shallower calices the larger septa end in large, vertically projecting teeth, which form a very distinct corona round the axial fossa. The columella is situated about 2 mm. below the top of the corona in the shallower calices, and is markedly oval in shape. It is in all the calices formed by an anastomosing mass of trabeculæ from the septal edges, and is much more compact in the shallower calices.

Of the other specimens, (*b*) is a small nodule with deep thin-walled calices. The columella is much larger and more compact than in the deep calices of (*a*), and the general facies of the

[1] "The Coral Reefs of Funafuti, Rotuma, and Fiji, together with some notes on the Structure and Formation of Coral Reefs in general." Proc. Camb. Phil. Soc. vol. ix., 1898.

specimen agrees closely with the form described by Milne-Edwards and Haime under the name of *P. profundicella*. A third specimen (*c*) conforms closely over the greater part of its surface with Dana's figures and descriptions of *P. virens*, with which the polyps of all agree in colour. The young calices, however, and those situated near the edges of the colony are precisely similar to calices in the same situation in specimen (*a*).

From the above it would appear that *P. profundicella* and *P. virens* can only be synonyms for different facies of *P. abdita*. It would also seem probable that several other species, described by various authors, are likewise synonyms.

Rotuma; crest of reef.

2. PRIONASTRÆA FUSCO-VIRIDIS Q. & G. (Plate XLVII. fig. 5.)

Astræa fusco-viridis, Quoy & Gaimard, Voy. de l'Astrol. iv. pl. xvii. fig. 8 (1833).

Astræa fusco-viridis, Dana, Zooph. p. 229, pl. xi. fig. 7 (1848).

Prionastræa fusco-viridis, Milne-Edwards & Haime, Cor. ii. p. 523 (1857).

I have referred two incrusting masses to this species because the polyps agree absolutely in colour with the above descriptions. The species, too, has priority over the species described by Ehrenberg, Milne-Edwards & Haime, and Dana, with several of which the corallum conforms equally well so far as the descriptions and figures go.

The peristome of the polyps is of a bright green colour, round which the external body-wall forms a broad brown ring. The calices vary in shape and depth in different parts of the corallum, but the dividing walls are always relatively thick, compact, and triangular in section. The septa are continuous from calice to calice, and are from ·5–1 mm. exsert. They vary in number, in the largest calices (1·4 cm. in diameter) often as many as 70 being counted, of which about 25 are subequal in size and fuse with the columella. These alternate with a similar number, which project about half as far, and then there are a number of very narrow septa, in calices of about 1 cm. diameter, scarcely recognizable. All the septa except the smallest are very thin, regular, and equally exsert. Their edges are covered with small, subequal, bluntly angular teeth, usually very close-set, and never have a ragged appearance. In some of the shallower, thicker-walled calices the teeth are often broader, and the section may have an almost precisely similar appearance to that given by Dana in pl. xi. fig. 7 *c*. The columella is usually well marked and compact, being formed by an anastomosing mass of thin trabeculæ, generally ending above in fine papillæ.

Rotuma; the species is very common, living on the extreme breaking edge of the reef. Similarly coloured species to this and *P. abdita* were also very common in the same position on the reefs of Wakaya, Fiji.

3. PRIONASTRÆA PURPUREA Dana.

Astræa purpurea, Dana, Zooph. p. 239, pl. xii. fig. 10 (1848).
Prionastræa purpurea, Milne-Edwards & Haime, Cor. ii. p. 524 (1857).

Dana states that this species differs from *P. pentagona* (Ehrenberg) only by the absence of a corona of teeth round the columella and the presence of a sulcus on the tops of the walls. Some of the calices of one of my two specimens show a corona of broad teeth round the columella and the sulcus is not always present. I have, however, retained Dana's name, as Ehrenberg's description is useless without reference to the original specimens, which are unknown.

The polyps and corallum agree absolutely with Dana's description and figures, except fig. 10 *b* of the septa. There are generally present 40–50 septa, of which about half are much thicker than the rest and fuse with the columella. The edges of these latter septa end usually in 6–9 fine rectangular teeth, often 1 mm. or more in length, and have rather a ragged appearance. The large septa are continuous between the calices with thin walls, but the sulcus is always marked by a deep notch immediately over the centre of the wall. The columella is always very well developed, usually oval in shape, about 3 mm. by 2 mm. It is generally situated about 2 mm. below the edges of the septa, and in surface view appears to be almost a solid mass, but is really composed of extremely fine and closely anastomosing trabeculæ.

Rotuma; reef with the preceding species. Two specimens.

P. gibbosa of Klunzinger appears to come very close in its characters to this species and is almost certainly identical with it. One of my dried specimens is rather gibbous, but this is not a specific character.

4. PRIONASTRÆA HIRSUTA Milne-Edwards & Haime.

Acanthastræa hirsuta, Milne-Edwards & Haime, Ann. des Sc. Nat. sér. 3, xii. p. 145 (1850), and Cor. ii. p. 502, pl. D 5. fig. 4 (1857).
Acanthastræa hirsuta, Klunzinger, Die Korall. des R. Meeres, iii. pl. v. figs. 1–2 (1879).

I have referred a small colony with 19 calices to this species, with which it agrees absolutely in all the characters given by Milne-Edwards and Haime. Budding takes place within the calices, and also very markedly over the costæ at the edge of the colony.

Funafuti.

5. PRIONASTRÆA ECHINATA Dana. (Plate XLVII. fig. 6.)

Astræa echinata, Dana, Zooph. p. 229, pl. xii. fig. 1 (1848).

I have referred a single specimen (about which I have no notes as to colour) to this species, with which it agrees absolutely in all the described and figured characters. There are about 30 septa,

of which in the largest calices (1·3 cm.) more than 20 often reach the columella. The latter is formed by a few coarse trabeculæ from the septal edges and is never very large. The walls in my specimen are nowhere more than 8·5 cm. in thickness, and in longitudinal sections are seen to remain of the same thickness throughout.

Rotuma; extreme edge of reef with the three preceding species.

6. PRIONASTRÆA TENELLA Dana.

Astræa tenella, Dana, Zooph. p. 231, pl. xiii. fig. 1 (1848).

A small colony rather doubtfully referred to this species and even to this genus.

Rotuma; outer reef.

Genus CYPHASTRÆA.

Cyphastræa, Milne-Edwards & Haime, Comp. rend. de l'Acad. des Sc. xxvii. p. 494 (1848), and Cor. ii. p. 484 (1857).

There does not seem to be any real difference between this genus and *Solenastræa*, but, as I have been unable to make any comparison of a large number of specimens, I have retained the generic name. There are only two specimens of the genus in the collection, both of which were found lying unattached in the boat-channel at Rotuma. They were, when found, both completely covered with polyps, and were the only corals obtained in the living condition from such a position.

1. CYPHASTRÆA CHALCIDICUM Forsk.

Madrepora chalcidicum, Forskål, Descr. an. in it. orient. p. 136 (1775).

Cyphastræa chalcidicum, Klunzinger, Die Korall. des R. Meeres, iii. p. 53, pl. v. fig. 8, pl. x. fig. 11 (1879).

One colony certainly identical with the specimens referred by Klunzinger to the above species. The specimen is a free, oval-shaped mass, 16 cm. by 10 cm. by about 7 cm. thick, completely covered with calices.

Rotuma; boat-channel.

2. CYPHASTRÆA SAVIGNYI Milne-Edwards & Haime. (Plate XLIX. fig. 1.)

Cyphastræa savignyi, Milne-Edwards & Haime, Ann. des Sc. Nat. sér. 3, xii. p. 115 (1850), and Cor. ii. p. 485 (1857).

A single specimen agreeing closely with all the characters given by the above authors. The colony is a round, free, flat mass—about 10 cm. across by 2·5 cm. thick—with eleven large blunt lobes at the edge, the whole completely covered with calices except for a small area on each side. The calices project commonly for about 1 mm. above the general surface, but a few are free for 2 or even 3 mm.; in diameter they are generally about 2 mm.,

but some again are much larger, varying up to 3·5 mm. The costæ are quite distinct, and the columella is, if present, extremely rudimentary.

Rotuma; boat-channel.

Genus Galaxea.

Galaxea (pars), Oken, Lehrb. der Nat. i. p. 72 (1815).
Galaxea, Milne-Edwards & Haime, Cor. ii. p. 223 (1857).

Most of the species in this genus are exceedingly ill-defined, and it seems probable that most of the so-called new species, described since Milne-Edwards and Haime's monograph, will prove to be synonyms. All the 'Challenger' species, with the possible exception of *G. explanata* Quelch, I should refer to previously known forms.

1. Galaxea laperouseana Milne-Edwards & Haime.

Carcinula laperouseana, Milne-Edwards & Haime, Ann. des Sc. Nat. sér. 3, x. p. 315, pl. vi. fig. 5 (1848).
Galaxea laperouseana, Milne-Edwards & Haime, Cor. ii. p. 231 (1857).

This species was first characterized by the irregularity in shape of the calices, their size, and three complete cycles of septa without any rudiments of a fourth, in all of which characters my specimens agree. The central calices of the mass and hence the oldest, as the budding is entirely from the edge, vary greatly in size; the largest I have found is 10·5 by 4·5 mm., while calices immediately around it are 5·5 by 4·5 mm., 9 by 5 mm., 7 by 5 mm., and 5·5 by 4 mm. The free portions of the calices vary up to 1·5 cm. in height above the peritheca, but are usually about 1 cm. The corallites are 2–3·5 mm. distant from one another at the surface of the corallum.

The primary and secondary septa are nearly equal in size and from 2 to 4 mm. exsert. The tertiary septa are from 1 to 2·5 mm. exsert, and generally are situated rather more externally than those of lower orders. The costæ of the tertiary septa are hence sometimes more projecting, but there is usually no marked difference between the costæ, all extending for about 2 mm. down the theca. The outlines of the primary septa are as shown in Milne-Edwards and Haime's figure, but the inner edge is commonly rather more vertical. The primary and secondary septa fuse in the centre of the calice, but there is no columella.

The peritheca is very light and formed of thin loose arches of corallum on one another. Its surface is continuous between the corallites, but below this it is much bored into by organisms and in places completely destroyed.

Rotuma; outer reef. Two specimens.

The largest specimen is 15 cm. by 8 cm. and 9 cm. thick. It is the growing edge of a large mass the central part of which has been killed. Over a great part of the upper surface an incrusting

growth of *Millepora*—generally not more than 1 mm. thick—has taken place, which over the dead calices very closely follows their septa. On the surface, too, a young colony of the same species of *Galaxea* is situated; it has 16 corallites, the largest being 3 mm. in diameter.

In the young corallites at the edges of the colonies all stages, from a cycle of six septa to the full three cycles, can be found. In the older calices the typical number of septa for three cycles, *i. e.* 24, is by no means constant, as many as 30 often being found, and it would appear that these are true variations in the number of septa and are not due to the presence of a few septa of a fourth cycle. In all cases thick and thin alternate, the latter situated always more externally on the theca.

2. GALAXEA FASCICULARIS Linnæus.

Madrepora fascicularis, Linnæus, Syst. Nat. edit. xii. p. 1278 (1763).

Madrepora fascicularis, Ellis & Solander, Zooph. p. 151, pl. xxx. (1786).

Galaxea fascicularis, Milne-Edwards & Haime, Cor. ii. p. 227 (1857).

After some hesitation I have referred two small specimens to this species. They agree in most respects with the above descriptions, but the calices are rather smaller, the largest being less than 1 cm. in greatest diameter and the majority only about 7 mm. The corallites and peritheca are comparatively light, and some of the former project for 2·3 cm. above the latter, the general height being little more than half this. The lower part of the peritheca has been destroyed, generally to within 6 mm. of its free surface, by boring organisms. The lower parts of the corallites remain, being formed of dense corallum, and the whole appears to have been growing very rapidly, perhaps owing to the boring organisms acting as a stimulus.

Wakaya, Fiji; reef.

I also obtained a single corallite of a colony of the same species from the chain of a buoy in Levuka Harbour, Fiji, which had been cleaned 22 months before. The corallite measures 2·3 cm. in height and 7·5 mm. by 5 mm. in diameter, so that the colony of which it formed a part must have been of considerable size.

EXPLANATION OF THE PLATES.

PLATE XLVI.

Fig. 1. *Caloria dædalea*, Ellis & Solander. Specimen *b*, × 1; p. 741.
2. „ „ „ „ *d*, × 1.
3. „ *sinensis*, Milne-Edwards & Haime, × 1; p. 742.
4. „ *astræiformis*, Milne-Edwards & Haime, × 1; p. 743.
5. „ *esperi*, Milne-Edwards & Haime, p. 743.
6. „ *edwardsi*, n. sp., × 1; p. 744.

PLATE XLVII.

Fig. 1. *Astræa denticulata*, Ellis & Solander, × 1 ; p. 748.
2. „ *okeni*, Milne-Edwards & Haime, × 1 ; p. 749.
3. „ *rotumana*, n. sp., × 1 ; p. 750.
4. *Prionastræa abdita*, Ellis & Solander, × 1 ; p. 758.
5. „ *fusco-viridis*, Quoy & Gaimard, × 1 ; p. 759.
6. „ *echinata*, Dana, × 1 ; p. 760.

PLATE XLVIII.

Fig. 1. *Symphyllia sinuosa*, Quoy & Gaimard, × ½ ; p. 738.
2. *Hydnophora lobata*, Lamarck, × 1½ ; p. 745.
3. „ *exesa*, Pallas, × ¾ ; p. 745.

PLATE XLIX.

Fig. 1. *Cyphastræa savignyi*, Milne-Edwards & Haime, × 1 ; p. 761.
2. *Orbicella wakayana*, n. sp., × 1½ ; p. 753.
3. „ *rotumana*, n. sp., × 1 ; p. 755.
4. „ *heliopora*, Lamarck, × 1 ; p. 756.
5. „ *funafutensis*, n. sp., × 1 ; p. 756.

4. On some Species of Shells of the Genera *Streptaxis* and *Ennea* from India, Ceylon, and Burma. By W. T. BLANFORD, F.R.S., V.P.Z.S.

[Received May 15, 1899.]

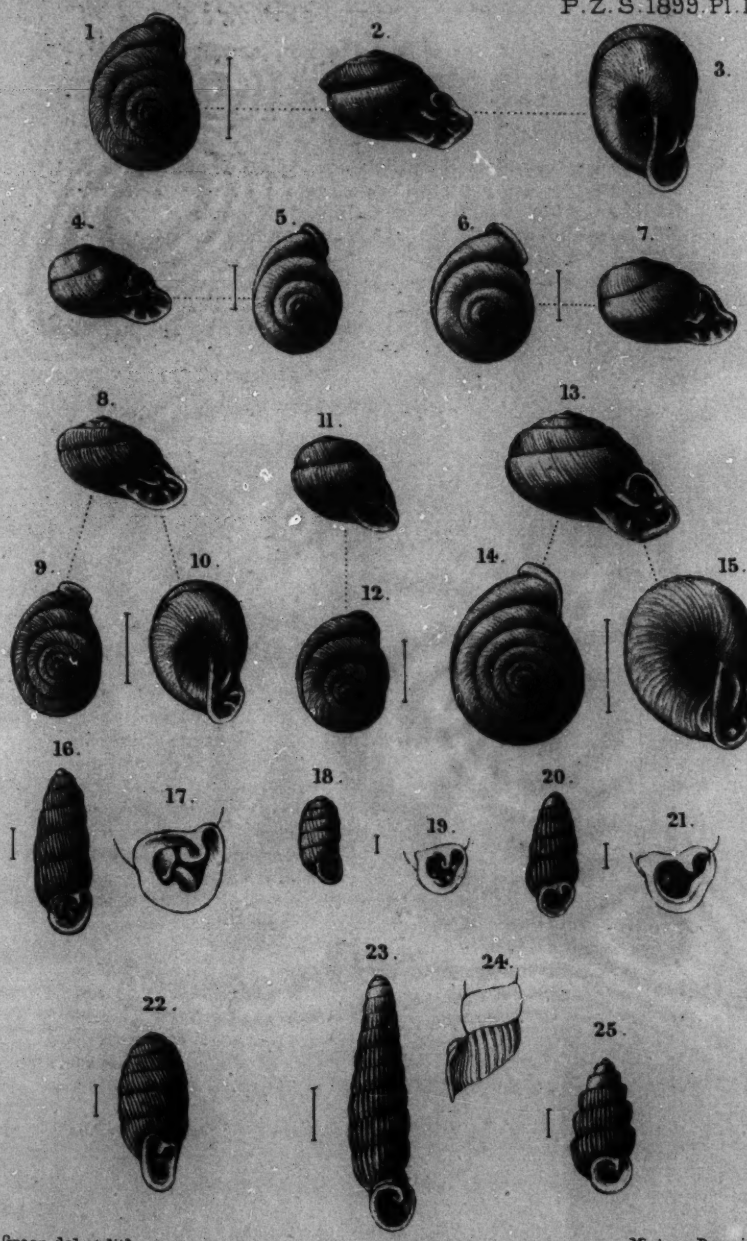
(Plate L.)

In the preparation of a general account of Indian terrestrial Mollusca, I have had occasion to go again over the somewhat numerous forms of *Streptaxis* and *Ennea* found in Southern India by Col. R. H. Beddome, from whose collections I described several species of those genera in 1880[1]. Col. Beddome has very kindly placed in my hands for examination the various additional forms subsequently obtained by him, and although only one more *Ennea* appears to require description, the case is different with *Streptaxis*. This genus abounds on the hills of Southern India, and shows so much variation that it is very difficult to say how many forms present characters sufficiently well marked to justify specific rank. If every variety were described as distinct, a large number of "species" or "subspecies" might be proposed. In the present case only those forms, three in number, which are well marked and easily recognized have received specific names.

A species of *Streptaxis* obtained by Col. Beddome in Burma and another that has long been in my own collection from Ceylon are also described; also an *Ennea* collected in the Nága Hills by Col. Godwin-Austen, and another species from the neighbourhood of Moulmein obtained by Mr. Theobald and now in the British Museum collection at South Kensington. Remarks on some other species are added.

Typical specimens of all the species here described are in the British Museum.

[1] J. A. S. B. xlix. pt. 2, pp. 201-211.



J.Green del. et lith. Mintern Bros. imp.

STREPTAXIS AND ENNEA.

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STREPTAXIS LÆVIS, sp. nov. (Plate L. figs. 11, 12.)

Testa umbilicata, depresso-ovata, lævigata, striatula, vitreo-albida; spira depresso-convexa; anfr. 5½, convexiusculi, penultimus ad peripheriam rotundatus, ultra ultimum subtus projectus, ultimus excentricus, subtus convexiusculus, post aperturam haud compressus; apertura diagonalis, fere semiovalis, lamellâ parietali intrante duobusque dentibus minutis, uno basali, alio sinistrali vix columellari, interdum carente, coarctata; peristoma expansum, margine dextro superne ad angulum sinuoso. Diam. maj. 8¼, min. 6; alt. 4⅓ mm.

Hab. Tenasserim (*Beddome*).

Very near *S. burmanicus* in form, but distinguishable from that and all other known Burmese species by the absence of costulation. Three specimens were collected by Col. Beddome. A near ally is *S. sinuosus* Pfr. from Cochinchina, but that is a much broader shell, with a smaller umbilicus.

STREPTAXIS BEDDOMII Nevill MS. (Plate L. figs. 4–7.)

Testa subumbilicata, depresso-ovata, lævigata, striatula, nitida, albido-cornea; spira parum exserta, sutura impressa; anfr. 5, convexiusculi, penultimus rotundatus, vix ultra ultimum (a basi spectatus) projectus, ultimus excentricus, basi convexus, post aperturam subtus compressus, utrinque juxta peristoma constrictus, in umbilico rugoso-striatus; apertura fere semielliptica, lamellâ unâ parietali, et dentibus 4 palatalibus, duo columellaribus, uno basali, uno dextrali coarctata; peristoma album, expansum, margine dextro ad angulum sinuato, et aliquando in tuberculo parvo parietali desinente. Diam. maj. 6, min. 4⅓; alt. 3 mm. (Figs. 4, 5.)

Hab. in montibus Animalai dictis Indiæ meridionalis (*Beddome*).

Var. *major, peristomate quinquedentato, dentibus duobus in margine dextro, uno basali, duobus columellaribus. Diam. maj. 7, min. 5; alt. 3½ mm.* (Figs. 6, 7.)

Hab. haud procul a Kuttálam (Courtallam) in comitatu Tinnevelly, ad alt. 4000 ped. (*Beddome*).

This species is near *S. watsoni*, W. & H. Blanf., but is distinguished by having only one parietal lamella; the teeth, too, are differently disposed in the mouth, but Southern Indian Streptaxes vary so frequently in their dentition that very little dependence can be placed on it. *S. beddomii* may, however, be recognized by having the proximal tooth on the columellar margin nearly halfway down, and both of the columellar teeth and the basal tooth are simple, equal in size, and nearly equidistant; whilst in *S. watsoni* there is often a small columellar tooth near the body-whorl, and a much larger elongate tooth, which is often more or less bifid, on the distal portion of the columellar margin.

The larger variety of *S. beddomii* from Tinnevelly is chiefly distinguished by having an additional tooth on the right margin above the tooth which is opposite the parietal lamella.

Amongst the specimens sent to me for examination by Col. Beddome is a single shell from the Wynaad which appears to be a still larger form, measuring 8, 6, and 4 mm.

STREPTAXIS SCALPTUS sp. nov. (Plate L. figs. 8, 9, 10.)

Testa rimato-perforata, subumbilicata, depresso-ovata, costulato-striata, subtus lævigata, cereo-albida; spira depresso-conoidea, sutura impressa; anfr. 5½–6, *convexi, penultimus ad peripheriam rotundatus, paullo ultra ultimum projectus, ultimus excentricus, subtus convexus, versus aperturam circa umbilicum compressus, utrinque fossiculo impresso coarctatus; apertura obliqua, fere semiovalis, lamellis plerumque duobus parietalibus approximatis, sinistrali mediâ longiore intrante, dextrali minore, aliquando carente, dentibusque ad quatuor (interdum* 2, 3 *vel* 5) *palatalibus constricta; peristoma album, expansiusculum, juxta angulum mediocriter sinuatum. Diam. max.* 10, *min.* 7 : *alt.* 5⅔ *mm.*

Hab. in montibus Kolamalai dictis, haud procul ab urbe Salem Indiæ meridionalis (*Beddome*), et in provincia Kadur, regni Indici Mysore (*Daly*).

This, like some other South Indian Streptaxes, is a very variable species. Even amongst specimens from the Kolamalais some shells are much more depressed than others, the largest examined measuring 11½, 8⅓, and 5½ mm. in its three diameters, whilst the smallest measures 8⅔, 6⅓, and 4⅔. The single specimen from Balur, in the Kadur district of Mysore, measures 10, 7½, and 5½. Then the palatal teeth vary in almost every individual examined: the normal arrangement appears to be two in the right margin, one of them opposite the end of the median parietal lamella, the other nearer the angle, one basal or distal, and one columellar nearer to the distal extremity of the aperture than to the proximal end. Some specimens (as in fig. 8) have two columellar teeth; in one shell the basal and columellar teeth are wanting, but this is evidently abnormal. Even in the excentricity of the last whorl, shown by the extent to which the penultimate projects when viewed from below, there is some variation.

This species is distinguished from most of the South Indian Streptaxes by its subcostulate striation. The species with similar sculpture are *S. pronus*, which is smaller and very differently shaped, and *S. canaricus* and *S. subacutus*, with the penultimate whorl keeled.

A single specimen from Torna was obtained some 30 years ago by Col. Evezard and has been in my possession ever since. It was noticed in "Contributions to Indian Malacology, No. xii." (J. A. S. B. xlix. pt. 2, 1880, p. 205), as coming from the most northern locality in Peninsular India from which a Streptaxis has been obtained. Torna is a Mahratta hill-fort, near Sinhgarh, south-west of Poona. The Torna shell is large (length 11½, breadth 8½, height 6 mm.) and somewhat weathered, with the whorls slightly sub angulate below the suture and with traces of spiral sculpture on

the last whorl. There are some faint impressed spiral lines on more than one of the Kolamalai specimens. The Torna specimen has only one parietal lamella and five palatal teeth, two being columellar. It should perhaps be classed as distinct.

STREPTAXIS SUBACUTUS, sp. nov. (Plate L. figs. 1, 2, 3.)

Testa arcuatim rimato-perforata, depresso-ovata, solida, flexuose costulato-striata, subtus lævigata; spira depresso-conoidea, apice acutiusculo; anfr. 6½, *planulati, penultimus ad peripheriam obtuse carinatus, dimidio latitudinis ultra anfractum ultimum projectus, ultimus valde excentricus, subtus convexiusculus, circa umbilicum versus aperturam angulatus, in umbilico rugoso-striatus, post aperturam fossiculo longitudinali subbasali impressus; apertura subdiagonalis, fere semiovalis, lamellis duobus parietalibus, unâ longiore mediâ, alterâ juxta angulum brevi, tribusque dentibus palatalibus, uno dextrali, secundo basali, tertio columellari, coarctata; peristoma expansum, margine dextrali ad angulum sinuato. Diam. maj.* 11½, *min.* 8; *alt.* 6 *mm.*

Hab. South Canara (*Beddome*).

This is the third and largest species of carinate *Streptaxis* from Southern India, the two others being *S. canaricus* and *S. compressus*.

These three species bring up the number of forms described from Southern India to eleven. Owing to the considerable amount of variation, especially in the teeth within the aperture, as already noticed, it is very difficult to make a key to these, but they may generally be identified by the following:—

A. Penultimate whorl rounded at periphery.

a. Parietal lamellæ 1 or 2, not Y-shaped, nor joined to margin of peristome by raised callus.

a. Shell above smooth or slightly striated.

a'. Penultimate whorl projecting on lower surface beyond last whorl.

*a*². Two parietal lamellæ (one sometimes in *S. perrotteti*).

*a*³. Length 8–10 mm.; usually 3 palatal teeth... *S. perrotteti.*

*b*³. Length 6½ mm.; 1 or 2 palatal teeth ..... *S. jootei.*

*c*³. Length 6 mm.; 3 to 5 palatal teeth..... *S. watsoni.*

*b*². A single parietal lamella; length 6–7 mm..... *S. beddomii.*

b'. Penultimate concealed by last whorl beneath ..... *S. concinnus.*

b. Shell costulately striated above ..... *S. scalptus.*

b. A single Y-shaped parietal lamella, arising from raised callus that unites margins of peristome.

a. Smooth; lower surface of penultimate whorl scarcely projecting ..... *S. personatus.*

b. Costulate; half of penultimate whorl projecting..... *S. pronus.*

B. Penultimate whorl keeled.

a. Costulate.

a. Length about 11½ mm.; 3 palatal teeth ..... *S. subacutus.*

b. Length about 7½ mm.; 6 palatal teeth ..... *S. canaricus.*

b. Smooth or striated; 4 or 5 palatal teeth ..... *S. compressus.*

STREPTAXIS RAVANÆ, sp. nov. (Plate L. figs. 13, 14, 15.)

Testa rimato-perforata, globoso-ovata, costulato-striata; spira convexa; anfr. 7, *planulati, infra suturam subangulati; penultimus ad peripheriam rotundatus, vix ultra ultimum, a basi spectatus, projectus, ultimus subtus convexiusculus, antice circum umbilicum compressus; apertura oblongo-semiovalis, plica intrante parietali et* 4–5 *dentibus palatalibus (duobus in margine dextro, uno basali, uno vel duobus columellaribus) coarctata; peristoma expansum, ad angulum retro-sinuatum. Diam. maj.* 13½, *min.* 10; *alt.* 7 *mm.*

Hab. in insula Ceylon.

This is a larger and more globose shell than *S. cingalensis* (which I am inclined to regard as a variety of *S. layardianus*) and with larger and more numerous palatal teeth. It is the largest known *Streptaxis* from the Indian area. I have had a single specimen for many years and am not quite sure from whom I received it, though I have always believed that it came from Major Skinner's collection.

ENNEA TURRICULA, sp. nov. (Plate L. figs. 16, 17.)

Testa breviter arcuato-rimata, turrita, subcylindrica, diaphana, nitidula, subdistanter capillaceo-costulata, cereo-albida; spira parum attenuata, apice obtuso, sutura impressa; anfr. 6, *convexi, duo superiores lævigati; apertura verticalis, fere semiovalis, lamellâ unâ tortâ parietali intrante, aliâ columellari obliquâ internâ, tertiâ basali profundâ, et tuberculis duobus, uno basali, alio in margine dextro, ambobus sæpe obsoletis, coarctata; peristoma album, callosum, expansum, vix ad angulum sinuatum, marginibus callo lamellifero junctis. Long.* 5, *diam.* 1¾; *ap. long.* 1¼ *mm.*

Hab. in montibus Animalai dictis, et in provincia Wynaad Indiæ meridionalis (*Beddome*).

The sculpture and dentition can only be distinctly seen in fresh adult specimens, in old shells some of the teeth in the aperture disappear. As in the allied forms *E. pirriei*, *E. macrodon*, &c., the dentition is well developed in half-grown shells.

This species is nearest to the Nilgiri *E. macrodon*, but distinguished by more distant sculpture, by the teeth in the mouth being smaller, and especially by the absence of the great transverse basal lamella of that species.

ENNEA BREVICOLLIS, sp. nov. (Plate L. figs. 23, 24.)

Testa turrita, subfusiformis, costulis filiformibus verticalibus ornata; spira sensim attenuata, apice obtuso, sutura impressa; anfr. 11, *convexi, primi* 3 *lævigati, ultimus angustior, antice breviter solutus, descendens et creberrime costulatus, utrinque versus basin scrobiculo compressus; apertura rotundo-ovalis, laminâ validâ curvatâ intrante parietali, et plicâ palatali oppositâ, coarctata, sinu ad dextrum subrotundo fere separato; peristoma albidum, expansum, reflexum. Long.* 8, *diam.* 2; *ap. long.* 1⅓ *mm.*

Hab. ad Moulmein (*Theobald*).

This is allied to *E. cylindrelloidea* Stol. and to *E. seatoni* Bedd. (P. Z. S. 1891, p. 315), and intermediate in size between them; it is distinguished from the smaller *E. cylindrelloidea* by coarser and more distant sculpture, and by the free part of the last whorl near the aperture being rather shorter. From the larger *E. seatoni* the present species may be known by its differently shaped mouth, which, as in *E. cylindrelloidea*, is nearly as high as broad, and by the absence, so far as can be determined in the only specimen available for examination, of the internal columellar plait. The parietal lamella is almost vertical in front, but the crest of it, inside the whorl, is bent towards the centre of the aperture, as in *E. cylindrelloidea*[1].

The type of *E. brevicollis* is a single specimen in the British Museum collection, labelled Damotha, Moulmein. This shell was obtained with others from Mr. Theobald in 1888, and has hitherto been supposed to be *E. cylindrelloidea*, of which there is no specimen in the collection. Whether the locality Damotha is correct it is impossible to say; probably *E. cylindrelloidea* and *E. brevicollis* are representative forms, found on different isolated limestone hills.

A single specimen of another *Ennea* belonging to the same group with the last whorl solute near the aperture has been presented to the British Museum by Dr. Hungerford and is also said to be from Damotha, Moulmein. It approaches *C. cylindrelloidea*, but is still smaller, being only 4 mm. long. It has 8 whorls and is smooth, not costulate. This is probably an undescribed species, but the only specimen looks slightly distorted, so I shall not propose a name for it.

ENNEA NAGAENSIS G.-A. MS. (Plate L. fig. 22.)

Testa longe curvato-rimata, cylindrico-ovata, oblique confertim flexuoso-costulata, cereo-albida, apice convexo, obtuso, sutura impressa; anfr. 7, *convexiusculi, ultimus minor, compressus, basi angustior; apertura auriformis, subaxialis, sinu subrotundo dextrali, a plicis duabus validis intrantibus proximis, unâ parietali, alterâ palatali in margine dextro, fere abscisso; peristoma albidum, undique incrassato-dilatatum, marginibus callo crasso longe ascendente junctis. Long.* 4¾, *diam.* 2; *ap. long.* 1⅝ *mm.* (*perist. incl.*).

Hab. in montibus Naga dictis (*Godwin-Austen*).

This shell is allied to *E. vara* Bs. and *E. stenopylis* Bs., the aperture, with its broadly expanded peristome and the subcircular sinus to the right almost cut off by the parietal and palatal plaits,

[1] I have been able, since the above was written, through the kindness of Dr. Alcock, Superintendent of the Indian Museum, Calcutta, to examine the type of *E. cylindrelloidea*. The parietal lamella is not curved into a hook, as might be supposed from the figure, J. A. S. B. 1871, pt. 2, p. 171, pl. 7. f. 4, and the copy of the same in the 'Conchologia Indica.' The hook-like appearance is due to the shading in the lithograph, intended to represent the curvature of the lamella inside the aperture, having been printed too darkly.

closely resembling that of the former species, whilst the general shape comes nearer to that of the latter, from which the present species is distinguished by having an additional whorl and more elongate proportions. The oblique flexuous costulation of *E. nagaensis* is finer than the sculpture of either of the allied forms.

Several specimens of this species were obtained by Col. Godwin-Austen in the Nága Hills.

ENNEA MILIUM G.-A. (Plate L. figs. 18, 19.)

In the original figure of this small form [1] the teeth within the peristome were wrongly drawn. I have recently been able, through Col. Godwin-Austen's kindness, to examine the original type, which is the only specimen hitherto obtained. The locality where this shell was found is in a tract of the lower Himalayas, very difficult of access, lying north of Assam. I find that instead of a single tooth in the right margin of the aperture there are two, one opposite the parietal lamella, the other lower and more internal; there is also a low broad basal tooth and an internal columellar lamella. A fresh figure is given herewith.

ENNEA CANARICA Bedd. (Plate L. fig. 25.)

This species was described by me in 1880 [2] but not figured, and as the form is a remarkable one, I make use of the present opportunity to give a figure. This and the next species differ considerably from the other South Indian Enneas, allied to *E. pirrici* and *E. macrodon*, forming the group to which *E. turricula* belongs. *E. canarica* is from South Canara.

ENNEA BEDDOMII Blf. (Plate L. figs. 20, 21.)

This was described with the last, and, like it, requires figuring. Both species were obtained by Col. Beddome, to whom I am indebted for specimens. *E. beddomii* is from the Sivagiri Hills, Tinnevelly.

EXPLANATION OF PLATE L.

Figs. 1, 2, 3. *Streptaxis subacutus*, p. 767.
4, 5. *S. beddomi*, p. 765.
6, 7. ,, var., p. 765.
8, 9, 10. *S. scalptus*, p. 766.
11, 12. *S. lævis*, p. 765.
13, 14, 15. *S. ravanæ*, p. 768.
16, 17. *Ennea turricula*, p. 768.
18, 19. *E. milium*, p. 770.
20, 21. *E. beddomii*, p. 770.
22. *E. nagaensis*, p. 769.
23, 24. *E. brevicollis*, p. 768.
25. *E. canarica*, p. 770.

[1] J. A. S. B. xlv. pt. 2, 1876, p. 317, pl. viii. fig. 11.
[2] J. A. S. B. xlix. pt. 2, p. 210.

June 20, 1899.

Dr. ALBERT GÜNTHER, F.R.S., Vice-President, in the Chair.

Mr. W. E. de Winton, F.Z.S., laid before the meeting a list of Mammals represented in a collection from British Central Africa that had been recently transmitted to Mr. Sclater by Mr. Sharpe, and made the following remarks :—

The good work of making collections of the fauna of Nyasaland for scientific purposes, started by the enterprise of Sir Harry Johnston, is being carried forward by the present Administrator, Mr. Alfred Sharpe, C.B., and the British Museum has just received a consignment of the larger Mammals through the Secretary of this Society. A list of the species, of which two are additions to those already reported, is as follows:—*Lycaon pictus*, *Hystrix* sp. inc., *Rhinoceros bicornis*, *Equus crawshayi*, *Connochætes johnstoni*, *Cephalophus lugens*, *Ourebia hastata*, *Hippotragus equinus*, and *Tragelaphus roualeyni*.

The *Lycaon*, a very fine male, and agreeing in every way with South-African specimens, is the first adult animal of this kind which has found its way to the National Collection from Nyasaland.

Two skins of Porcupines are unfortunately not accompanied by skulls, and in the absence of these it would be impossible to say to what species they belong. As has been pointed out by Mr. Oldfield Thomas (P. Z. S. 1896, p. 795), a Porcupine was sure to inhabit this district, and it is to be hoped that the skulls of these two specimens will be forthcoming later on.

Of the large mammals the only one new to the district is a Roan Antelope, and the very fine specimens of both sexes contained in the present collection show that the Nyasaland animal agrees with the typical form from Mashonaland.

It will be well to point out an error in the description of the Nyasaland Gnu and in the figure of that species in P. Z. S. 1896, pl. xxviii. In the dried skin the white mark on the face is distorted by the contraction of the thick skin of the suborbital glands, and has led the artist into the mistake of depicting the animal with a white **V**-shaped band instead of a chevron or **Λ** on the face. An excellent photograph, taken by Mr. James Harrison, of a freshly killed specimen shows the correct marking very plainly.

Mr. de Winton exhibited the mounted heads of a male and female Red-flanked Duiker (*Cephalophus rufilatus* Gray) (see figure, p. 772), obtained by Mr. J. F. Abadie in the Borgu Country of the Niger district; also the skull of a male of the same species obtained by Capt. W. Giffard near Gambaga, in the back-country of the Gold Coast. The horns of the latter specimen measured 3·35 inches (or 86 millim.) in length, the basal length of the skull measured 5·3 inches (or 134 millim.), the greatest breadth of the skull (which is

found in the squamosal portion of the zygomatic arch) 2·8 inches (or 71 millim.).

Skull of *Cephalophus rufilatus*, ♂. ⅔ nat. size.
(From Capt. Giffard's specimen.)

Capt. Giffard had appended the following note—"Not uncommon, very solitary in its habits, never seen more than 100 yards from water."

In size this Duiker closely resembled the Red Duiker of South Africa (*C. natalensis*), and perhaps this would be found to be its nearest ally, though the slate-coloured legs and dorsal stripe as well as the more massive horns were distinctive of the Red-flanked Duiker. Both the Black-fronted Duiker (*C. nigrifrons*) from Gaboon and Harvey's Duiker (*C. harveyi*) from East Africa were much larger animals and are otherwise widely distinct.

The Hon. Walter Rothschild, F.Z.S., read a memoir on the Cassowaries, which contained notes on, and an enumeration of, the species and geographical races of these birds. He also exhibited the originals of the plates which are to illustrate the paper when published in the Society's 'Transactions,' and made the following remarks:—

My interest in the Ratitæ was first aroused as far back as 1876, when a pair of Emus (*Dromæus novæ-hollandiæ*) were brought over by Mr. Cyril Flower (now Lord Battersea) from Australia and turned loose in Tring Park. I well remember the universal excitement at home in 1877 when the first of the beautiful dark green eggs was found. Since that time Tring Park has never been without some representative of the Ostrich tribe, either Rhea, Emu, Apteryx, or Cassowary.

However it was in 1890 when I first turned my attention seriously to the genus *Casuarius*, induced to do so by the abominably stuffed and grotesquely coloured specimens preserved in all our museums. I proceeded to devise a method by which their natural appearance could be better displayed.

The first step was to get some alive, and I procured two Ceram Cassowaries, a Westerman's Cassowary, and two Australian Cassowaries. I then, when they were in full colour, got an artist to make careful drawings from life. Finally, with the help of a Cambridge taxidermist, we succeeded in modelling Cassowaries so true to life that a photograph from the mounted specimen was barely distinguishable from one taken from life.

In 1896 I promised to work out and monograph for the German Zoological Society the two families of *Paradiseidæ* and *Ratitæ*, for their great work 'Das Thierreich.' Finding no figures or descriptions, not even those of the 'Catalogue of Birds in the British Museum,' of any great value to me in the work for the Ratitæ, I determined to get together a collection of all the Ratite Birds alive. I had at the time 5 out of the 6 forms of *Apteryx* alive; in the Society's Gardens 2 out of the 3 forms of *Struthio* were represented; while at Tring I had *Dromæus novæ-hollandiæ* and *D. irroratus*, 3 *Casuarii*, and *Rhea americana* alive, and *Rhea macrorhyncha* at the Society's Gardens. In collecting the species and varieties of Cassowary during 1896, 1897, 1898,

and 1899, I was much struck by the inadequate figures and descriptions hitherto available, and I thought it might be useful if I published a monograph of the genus *Casuarius*, with coloured figures and a detailed anatomical description.

As my own journal was of too small a size to allow characteristic plates to be given, I laid the matter before the Publication Committee and the monograph was accepted for publication in the 'Transactions.'

I now place before you the original drawings for this monograph and a photograph of one of the birds. I find there are fewer distinct species than has been hitherto supposed (11 are enumerated by Count Salvadori); but, owing to their solitary habits and restricted though wide distribution, most of the species have developed into a number of local races or subspecies.

Of distinct species I recognize 8, viz.:—

1. *Casuarius casuarius* (Linn.), from Ceram, Aru, New Guinea, and Australia.
2. *Casuarius bicarunculatus*, from Wammer and Kabroor Islands, Aru Islands.
3. *Casuarius uniappendiculatus*, from Salwatti and Jobi Islands and the northern shores of German and Dutch New Guinea.
4. *Casuarius papuanus*, from Salwatti and Dutch New Guinea.
5. *Casuarius picticollis*, from German and British New Guinea (lowlands).
6. *Casuarius loriæ*, from British New Guinea (high mountains).
7. *Casuarius bennetti*, from New Britain.
8. *Casuarius philipi*, habitat uncertain.

Taking cognizance of all the races, we find there are 18 recognizable subspecies as follows:—

1. *Casuarius casuarius.* Ceram.
   (a) „ *casuarius beccarii.* Vokan, Aru Islands.
   (b) „ *casuarius salvadorii.* Arfak.
   (c) „ *casuarius sclateri.* New Guinea, from Maclure Inlet to Samarai.
   (d) „ *casuarius violicollis.* Trangan Island, Aru Islands.
   (e) „ *casuarius australis.* Queensland.
   (f) „ *casuarius intensus.* Habitat uncertain.
2. *Casuarius bicarunculatus.* Wammer and Kabroor, Aru Islands.
3. *Casuarius uniappendiculatus.* Salwatti and Arfak.
   (a) „ *uniappendiculatus occipitalis.* Jobi Islands and Geelvink Bay.
   (b) „ *uniappendiculatus aurantiacus.* Huon Gulf, German New Guinea.

4. *Casuarius philipi*. Habitat uncertain.

5. *Casuarius papuanus*. Salwatti and Arfak.

(a) „ *papuanus edwardsi*. Geelvink Bay.

6. *Casuarius picticollis*. British New Guinea (low country).

(a) „ *picticollis hecki*. German New Guinea.

7. *Casuarius loriæ*. Owen Stanley Range, British New Guinea.

8. *Casuarius bennetti*. New Britain.

Besides these, two forms have been distinguished, *Casuarius laglaizei* and *Casuarius tricarunculatus*, which are not worthy of distinction; the former is founded on a melanistic specimen of *C. uniappendiculatus occipitalis*, and the latter on a monstrosity with three wattles of *C. casuarius salvadorii*.

I have been most successful in procuring living specimens of Cassowaries, and during the last 10 months I have had alive 14 out of the 18 forms; and of the drawings exhibited, only two have not been executed from life, namely, *Casuarius picticollis*, taken from a drawing by Hart made from the bird in the flesh three hours after death, and *Casuarius loriæ*, copied from a sketch by Dr. Loria, from the fresh shot bird, taken on the spot in the Moroka District, S.E. New Guinea. It appears, from the only two adult pairs (*i. e.* males and females) of Cassowaries I have had the good fortune to observe, that in the subspecies of *Casuarius casuarius* the males have the wattles separated for their entire length, while the females have them joined at the base.

I may be allowed to remark that considering the usual manner of securing living Cassowaries (*i. e.*, by shooting the old male and catching his brood of chicks when still in down), the disproportion in the sexes seems to be most astounding: out of 180 Cassowaries which have passed through my hands alive, only 6 were males and 172 were females.

The few additional remarks I have to make here are that all Cassowaries are very quarrelsome and savage, and I have only known two tame birds, both *Casuarius casuarius violicollis*; but by far the most ill-tempered and dangerous birds are the forms of *C. papuanus* and *C. uniappendiculatus*.

That we do not know nearly all the races of Cassowary is amply proved by two young birds, both forms of *Casuarius casuarius*, now in my possession, which promise to develop into two very distinct forms: in fact, although young and in brown plumage, I should describe them at once if it were not for the fatal double wattles characteristic of the type of the genus and which therefore denote that the distinctions may be transitory. In the monograph itself I hope to insert everything, anatomically, zoologically, and biologically, known up to the present date.

I may mention that the *C. casuarius australis* now in the Society's Gardens is one of my original two, purchased in 1890. It is generally believed, and even positively stated in a number of books, that the Australian Cassowary (*Casuarius casuarius australis*)

is the largest Cassowary; but it is much exceeded in bulk and height by *Casuarius casuarius sclateri* and *Casuarius uniappendiculatus* when perfectly adult.

This paper will be published in full in the Society's 'Transactions.'

The following papers were read:—

1. On the Remains of a new Bird from the London Clay of Sheppey. By Chas. W. Andrews, B.Sc., F.Z.S.

[Received June 2, 1899.]

(Plate LI.)

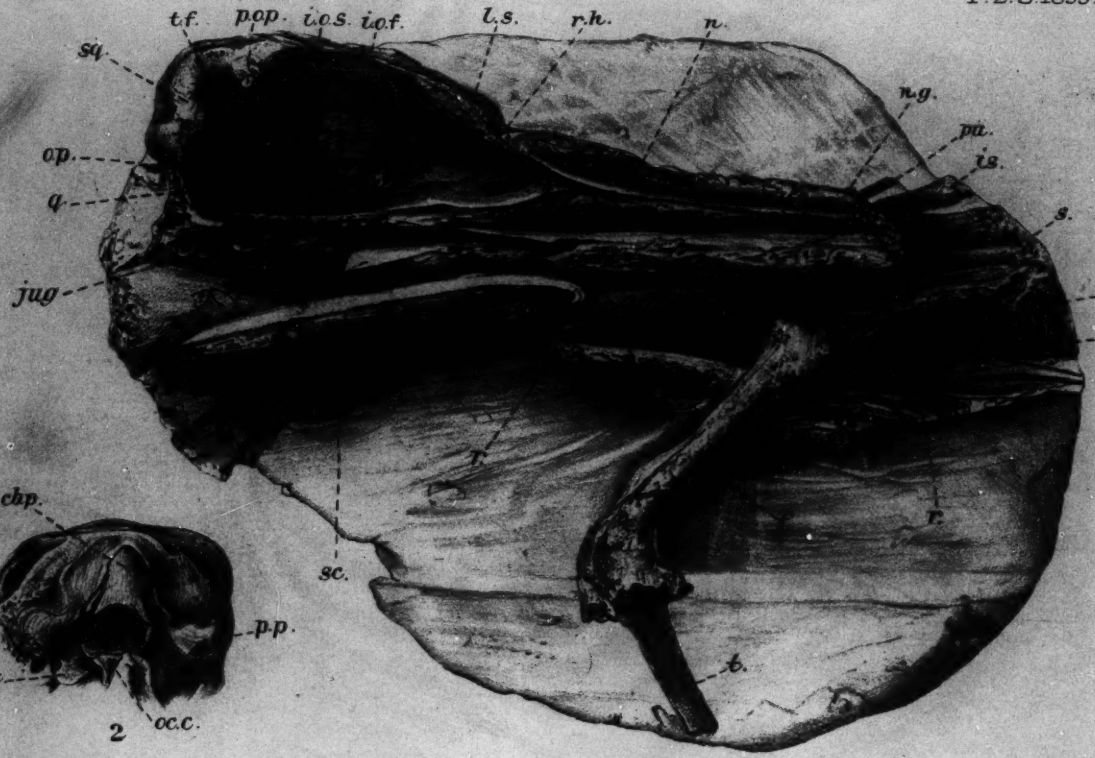
The fossil birds hitherto recorded from the London Clay are so few in number, and present such remarkable characters, that the discovery of a new member of the Class from that horizon is of the greatest interest.

The National Collection has recently been enriched by the addition of a clay nodule enclosing the skull, pelvis, and some broken limb-bones of a new type of bird, which forms the subject of the present paper. This specimen was obtained by that indefatigable collector W. H. Shrubsole, Esq., F.G.S., from the London Clay of the Isle of Sheppey, a locality with which he has long been associated. When found, one side of the skull and some fragments of limb-bones were all that was exposed; but the skilful removal of the matrix by Mr. J. Hall, assistant formatore in the Museum, has revealed most of the skull, the upper surface of the pelvis, and the femur; there are also remnants of the vertebral column and ribs. The bird is lying with the head turned round over the back, so that the lower surface of the beak rests on the iliac crest of the pelvis; behind the head several of the anterior cervical vertebræ are visible, and in front of the pelvis there are some thoracic vertebræ, but the posterior cervical and the anterior thoracic vertebræ, together with the sternum and coracoid, have been lost by the abrasion of the nodule. The upper portion of the scapula and the left femur still occupy nearly their natural position.

It may be stated at once that this specimen indicates the existence of a new species of a type differing generically from any previously known bird, but allied to the Tropic-birds (*Phaethon*), of which it may be an ancestral form; for it I propose the name *Prophaethon shrubsolei*, referring to its suggested affinities and in honour of the discoverer of the specimen.

The Skull and Mandible.

The skull and mandible are, on the whole, in a remarkably good state of preservation. The tip of the beak and a portion of its upper surface have been broken away; the lachrymals are missing;



J.Green del.et lith.

PROPHAETHON SHRUBSOLEI.

Mintern Bros. imp.

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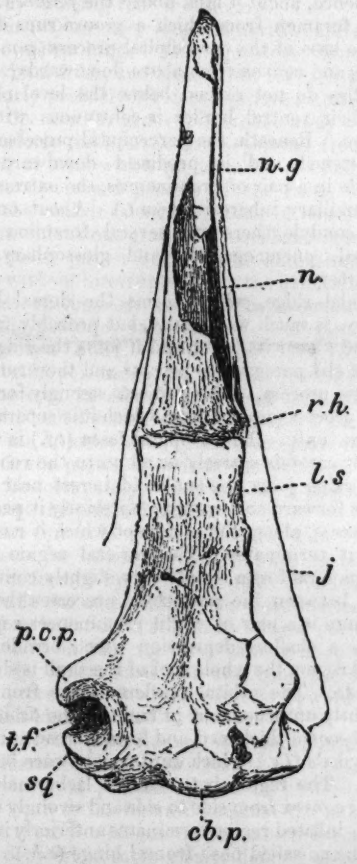
and on the exposed (right) side the postorbital and zygomatic processes, together with the outer half of the quadrate, are much abraded.

Fig. 1.



Skull of *Prophaethon shrubsolei*, from above. Natural size.

cb.p., cerebellar prominence; *j.*, jugal; *l.s.*, surface for articulation with lachrymal; *n.*, external nares; *n.g.*, narial groove; *r.h.*, rostral hinge; *sq.*, squamosal; *t.f.*, temporal fossa; *p.o.p.*, postorbital process.

The occipital surface (Plate LI. fig. 2) of the skull is wider than it is high. The sessile occipital condyle (*oc.c.*) is nearly

hemispherical, its upper border being very slightly flattened. The *foramen magnum* is relatively large and is subcircular, the lateral and ventral borders being slightly flattened. Above the foramen there is a well-marked cerebellar prominence (*cb.p.*) from which the bone has been almost entirely broken away. On either side of the prominence, about 4 mm. above the *foramen magnum*, is a small vascular foramen from which a groove runs downward and outwards to the base of the paroccipital process (*p.p.*). These processes are large and convex from above downwards; their rounded outer extremities do not extend below the level of the *foramen magnum* and their ventral border is continuous with the supra-foraminal ridge. Beneath the paroccipital processes the occipital surface is flattened and is produced downward beneath the occipital condyle in a pair of prominences, the extremities of which form the mammillary tuberosities (*m.t.*). About on the level of the occipital condyle there are several foramina (transmitting the hypoglossal, pneumogastric, and glossopharyngeal nerves, and ? carotid artery).

The lambdoidal ridge, which forms the dorsal border of the occipital surface, is much worn away, but probably was never very strongly marked; near its lower end it joins the ridge forming the outer border of the paroccipital process and then runs forward on to the zygomatic process. This projects strongly forward towards the postorbital process (*p.o.p.*), from which it is separated by a space of about 6 mm. only. The temporal fossa (*t.f.*) is very deep and well-defined; it extends scarcely at all on to the roof of the skull. The temporal ridge joins the lambdoidal crest near its outer end and then passes forward and inward: anteriorly it passes on to the postorbital process, along the middle of which it runs and at the tip of which it terminates. The parietal region of the skull between the temporal fossæ is only very slightly convex, but in the frontal region between the postorbital processes the convexity is greater, and there is a pair of slight prominences separated in the middle line by a shallow depression which broadens out till in the interorbital region the whole roof of the skull is slightly concave from side to side. The orbital borders of the frontals are thin, sharp, and slightly upturned, but in front of the orbits the edges of the skull-roof become thickened and form a broad surface for union with the lachrymals (*l.s.*), which unfortunately are both wanting in this specimen. The region between the lachrymals is somewhat swollen, slightly convex from side to side and strongly so from before backward; this inflated region terminates anteriorly in a deep transverse groove, the so-called naso-frontal hinge (*r.h.*). As a matter of fact this groove does not occur at the junction of the nasals and frontals, at least in *Phaethon*, to which the present species is most nearly allied. In the skull of a young individual of *P. æthereus* described by Mr. W. P. Pycraft, the groove divides the nasals into a posterior inflated portion and an anterior region cleft by the nares and separated one from another by the facial processes of the premaxillæ; it will therefore be better to speak of this hinge as "rostral" instead of fronto-nasal.

Immediately in front of the rostral hinge the upper surface of the beak is broad and slightly convex from side to side; but as it passes forward between the nares (*n.*) it becomes narrower and more rounded, and continues to do so as far forward as preserved, the tip being lost: between the nostrils a portion of the bone is broken away showing that it is hollow.

The nostrils (*n.*) are very long and narrow, and extend backward nearly to the rostral hinge. They are widest immediately in front of the antorbital fossa, and thence run forward as a narrow cleft, which anteriorly probably becomes a groove (*n.g.*); the anterior end of the narial opening (or groove) is broken away with the tip of the beak. Posteriorly the nostrils are separated from the antorbital fossa by a bar of bone which no doubt is, as usual, formed by the union of the downward process of the nasal with the maxilla. The edge of the beak is formed by a bar of bone, which is narrow anteriorly but widens out gradually from before backward, reaching its greatest width just in front of the antorbital fossa. Behind this it passes without interruption into the quadrato-jugal bar (*jug.*). The thickness of this bar seems to be constant throughout its length, but the posterior extremity where it joined the quadrate has been broken away. The interorbital septum (*i.o.s.*) is incomplete, being perforated by a large quadrate fenestra (*i.o.f.*), similar to that seen in *Phaethon*. It has been cleared of matrix so that the thickened ventral edge (rostrum) is exposed, and it can be seen that the anterior ends of the pterygoids rest against it and articulate with the posterior ends of the palatines as in most Carinate birds. Unfortunately, it has not been possible to work out the structure of the palate further.

The *quadrate* (*q.*) is long and articulates with the skull by two heads, the facets for which are situated very far back, immediately within the rim formed by the lower edge of the paroccipital. On the exposed side the outer half of the quadrate has been abraded, and its distal articulation is still in its natural position with regard to the mandible, so that its form cannot be observed. Rather high up on the inner border of the bone there arises a fairly large orbital process (*o.p.*) which projects upward and inward and terminates in a blunt point.

In the *mandible* the posterior end is so much injured that its form cannot be determined, but there seems to have been a fairly prominent postero-internal process. From its posterior end the ramus increases in depth as far forward as about the middle of the orbit. At this point there is a lateral vacuity which is continued forward as a shallow depression, most clearly defined above, and of which the anterior end is opposite the middle of the nostril. In front of this depression the mandible tapers towards its anterior end, and its outer surface becomes rounded from above downward; the extreme tip has been broken away. It cannot be seen whether there was a distinct coronoid process or not, because the upper border is hidden behind the jugal bar. Beneath and behind the lateral vacuity the suture between the dentary and the articular region remains distinct.

The general aspect of this skull at once gives the impression that it belonged to a Steganopodous bird, and the details of its structure confirm this view: for instance, the extreme posterior situation of the quadrate and the form and position of its orbital process are very characteristic of this group.

Comparison of this skull with those of other Steganopodes shows that it is sharply distinguished from the skulls of *Phalacrocorax* and *Plotus* in several points. Thus in these genera—(1) the temporal fossa is much larger and its form and relations are different; (2) the form of the occipital region is different; (3) the cranial region is greatly elongated, so that the small orbital process of the quadrate is separated from the orbit by a considerable interval; (4) the roof of the skull behind the rostral hinge is not inflated; (5) the interorbital septum is ossified to a much smaller extent.

The skull of *Sula* differs from the fossil in the following points:—(1) the temporal fossæ are larger; (2) the quadrate is situated somewhat less posteriorly; (3) the roof of the skull is not inflated behind the rostral hinge; (4) in the adult the nostril is reduced to a minute foramen.

There is some similarity between the two birds in the form of the occipital surface, the degree of ossification of the interorbital septum, and in the presence of a deep *temporalis* recess.

Apart from the large size and peculiar form of the beak, the skull of *Pelecanus* differs from the fossil in (1) large size of orbital process of the quadrate; (2) the absence of inflated surface behind the rostral hinge; (3) the complete ossification of the interorbital septum; (4) the absence of a *temporalis* recess.

The skull of *Fregata* differs in (1) the rather larger temporal fossa; (2) the much more complete interorbital septum; (3) large size of orbital process of quadrate; (4) absence of rostral hinge; (5) the depressed form of the posterior portion of the beak and in the small size of the nostrils.

It is to the skull of *Phaethon* that the fossil approaches most nearly. Thus the form of the *foramen magnum* and the occipital surface, the structure and relations of the quadrate (as far as can be determined), the form of the cranial region of the skull, the inflation of the anterior portion of the roof immediately behind the rostral hinge, are exactly similar in the two forms. Other points of likeness are to be found in the presence of a *temporalis* recess and the form of the interorbital septum.

The chief points of difference are:—(1) in *Phaethon* the temporal fossæ are slightly larger; (2) the skull-roof in front of orbits is rather wider; (3) the beak is relatively shorter and the nostrils smaller. As to this latter point, however, it is worthy of note that, as Pycraft has pointed out, in a young skull of *Phaethon* the narial openings are very much larger than in the adult, and extend back nearly to the rostral hinge as narrow clefts, so that the holorhinal nares of the adult appear as nearly schizorhinal in the young. I have further observed that in some cases, at least, in the adult, traces of the cleft-like posterior portion of the openings remain

as one or two minute foramina, marking points where the closure of the cleft is incomplete. Probably in the early ancestors of *Phaethon* the nares were schizorhinal, and in *Prophaethon* they still approximate to that condition. It must be pointed out that in the Steganopodes generally there seems to be a strong tendency to the reduction in size of the external nares, and in *Sula* this has been carried so far that the opening is reduced to a very small foramen; and it is remarkable that in *Odontopteryx*[1], which was a contemporary of *Prophaethon*, this condition seems to have been already attained, so that in this respect this Eocene type is more specialized than the recent *Phaethon*.

So far as the evidence of the skull goes, it may be concluded that *Prophaethon* approaches very nearly to *Phaethon*, of which it is probably an ancestral form, exhibiting in a few points more primitive characters.

The dimensions of the skull and mandible are:—

	millim.
Total length from occ. condyle (tip of beak wanting) ..	112
Width at squamosal prominence (approx.)	40
Width at temporal fossæ	26
Width at postorbital process	46
Width between orbits	17
Width at rostral hinge	16
Width of beak opposite anterior angle of antorbital vacuity	16
Diameter of *foramen magnum*	8
Length from occipital condyle to rostral hinge in straight line	51

The Pelvis. (See Plate LI. and text-figure 2, p. 782.)

By the careful removal of the matrix a great part of the pelvis is now exposed, but it is incomplete posteriorly and the right side of the preacetabular portion is still concealed.

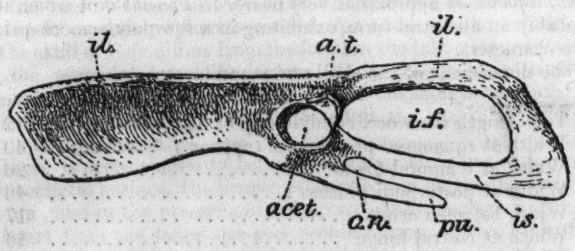
In the preacetabular region the ilia are united along the middle line with the neural spines of the sacral vertebræ to form a broad low iliac crest. Their lateral (gluteal) surfaces are very concave, and they seem to have been widened out anteriorly as in the pelves of *Phalacrocorax* and *Plotus*.

Just in front of the acetabulum the dorsal edges of the ilia diverge one from another and the whole pelvis increases in width,

[1] This bird is regarded by most authors as an undoubted Steganopod, but in his original description Owen pointed out some points of resemblance with the Anserine birds. I have lately cleared the matrix from the orbit, quadrate, and pterygoids of the type specimen, and the new characters thus revealed point rather strongly to Anserine affinities: for instance, the form of the pterygoids is extremely duck-like, and they articulate by broad subcircular surfaces, situated at their anterior ends, with corresponding facets near the base of the rostrum; many of the Steganopod-like characters, however, are of considerable importance. I hope shortly to publish a note on *Odontopteryx* with figures of the quadrate and pterygoids.

its widest point being at the antitrochanters (*a.t.*). The pelvic escutcheon narrows somewhat towards its posterior end; in its middle line the neural spines of the sacral vertebræ form a slight ridge, on either side of which there are some traces of interosseous foramina, at least posteriorly, but these openings are not developed to anything like the degree seen in *Phalacrocorax* or *Plotus*. The line of junction of the postacetabular portion of the ilium with the synsacrum can be seen. Above the ischiadic foramen the ilia are very narrow and convex from side to side.

Fig. 2.



Pelvis of *Prophaethon shrubsolei*; partly restored from the opposite side. Natural size.

acet., acetabulum; *a.t.*, antitrochanter; *i.f.*, ischiadic foramen; *il.*, ilium; *is.*, ischium; *o.n.*, obturator notch; *pu.*, pubis; *s.*, sacrum.

The ischia (*is.*) consist anteriorly of a narrow bar convex externally; posteriorly they become greatly expanded and fuse with the ilia, closing a large ischiadic foramen (fig. 2, *i.f.*), the shape of which is an irregular oval. The posterior angles of the ischia are broken away, but they seem to have extended backward and downward as in *Sula*.

Of the pubes (*pu.*) only the proximal portion of that of the left side is preserved. The obturator notch (fig. 2, *o.n.*) remained open posteriorly, but there are indications of a blunt process on the ischium which at least partly closes it.

Beneath and in front of the acetabulum, on the right side, there is a prominent knob of bone, which was at first mistaken for the pectineal process, but which is actually merely a fragment of bone, probably of the femur.

There are remains of two or three ribs (*r.*), two of which emerge from beneath the ilia and probably articulated with the anterior synsacral vertebræ.

The left femur (*f.*), lying in nearly its natural position with regard to the pelvis, is fairly well preserved except at its distal end. Unfortunately only its outer surface is visible, so that it supplies

no important information as to the affinities of the bird. It can, however, be seen that the bone is relatively rather short and stout, and that the outer surface of the trochanter is broad and flat and projects forward considerably in advance of the shaft. The proximal end of the tibia (*t.*) is also preserved, but is too imperfect for description.

The cervical and dorsal vertebræ are represented by mere fragments, and the only other bone of the skeleton at all well preserved is the scapula (*sc.*), the blade of which is nearly perfect. It lies in approximately its natural position nearly parallel to the vertebral column; its tip just overlaps the front of the pelvis, and its upper edge for a short distance conceals the lower border of the mandible. The portion preserved is slender, but less so than is the corresponding part of the scapula of *Phaethon*; its distal end is slightly expanded. From this bone as here preserved no information of importance as to the affinities of the bird can be derived.

Comparison of the pelvis of *Prophaethon* with those of other Steganopodes shows that in its general form it resembles that of *Sula* most nearly. The chief differences are that in the fossil the interosseous foramina are less distinct, the upper surface of the postacetabular region of the ilia more convex from side to side, and the pelvic escutcheon narrows less towards the hinder end. The pelves of *Phalacrocorax* and *Plotus* somewhat resemble the fossil in the expansion of the anterior end of the preacetabular ilia, but differ from it in the large size and number of the interosseous foramina which commence opposite the acetabulum, in the general form of the pelvic escutcheon, and in the presence of a sharp ridge (most prominent in *Plotus*) near the inner border of the postacetabular region of the ilium.

From the pelves of *Fregata* and *Phaethon* the fossil differs greatly. In both these genera the pelvis is very wide and shallow, and the ilia are widely separated throughout their length by the synsacral vertebræ, the transverse processes of which are exposed, or at least covered only with ossified fascia (*e. g.*, in part of the preacetabular region of *Phaethon*). In fact the fossil pelvis differs much more from those of *Phaethon* and *Fregata* than from that of any other of the Steganopodes; but since the skull shows conclusively that *Prophaethon* is by far most closely related to *Phaethon* some explanation of this difference is necessary. If the pelves and hind limbs of *Fregata* and *Phaethon* be examined, it will be found that, in proportion to the size of the body, they are very small and clearly in a degenerate condition. The explanation of this seems to be that neither of these birds make use of their hind limbs nearly so much as the other Steganopodes, for although no member of the group employs its hind limbs to any great extent, all except *Phaethon* and *Fregata* use them in swimming both on and under the surface of the water. I have lately had an excellent opportunity of observing the habits of both Frigate and Tropic birds, and I believe that they subsist entirely on surface-fish and

molluscs, or, in the case of the Frigate-bird, on what they can take from the Gannets and other birds. I never saw either really dive, although they drop down to pick up food from the surface of the sea, and on one occasion only I saw a Tropic-bird sitting on the water. This being the case, it appears that the hind limbs are scarcely used at all, and the reduction in size that has been undergone by the pelvis and hind limb is no doubt correlated with this disuse. In *Prophaethon* both pelvis and hind limb seem to have retained their normal relative size, and this bird was probably a good swimmer and diver and resembled *Sula* and *Phalacrocorax* both in its habits and in its structure more nearly than does its modern representative *Phaethon*, many of the peculiar characters of which have been acquired since the Eocene. Nevertheless, *Phaethon* presents many peculiarities which indicate that it is really a somewhat primitive type, and probably the stock of which *Prophaethon* and *Phaethon* are the middle and terminal members branched off from the common stock of the Steganopodes at a very early period, perhaps not later than about the beginning of the Cretaceous. It is known that the group is a very ancient one, for Marsh has described several species (*Graculavus*) which occur in the Upper Chalk, and were regarded by him as almost certainly Steganopodes which already show relationship with the Cormorants.

The dimensions of the pelvis are:—

	millim.
Total length as preserved	88
Width at antitrochanter	27
Width at middle of pelvic escutcheon	15
Length in front of antitrochanter	49
Length of ischiadic foramen	25

The dimensions of the femur are:—

	millim.
Length (approximate)	52
Antero-posterior width of outer surface of trochanter	11
Width of middle of shaft	5

Conclusions.

The conclusions arrived at from the examination of this specimen may be summarized as follows:—

(1) The structure and position of the quadrate and the form of the pelvis indicate that the fossil is a Steganopodous bird.

(2) The form of the cranial region of the skull and of the rostral hinge, as well as some other points, indicate that it is most nearly related to *Phaethon*.

(3) The relatively large size of the pelvis and femur indicate that the bird more nearly resembled the ordinary Steganopodous type than does *Phaethon*, in which the pelvis and hind limb are in a greatly reduced condition.

EXPLANATION OF PLATE LI.

Fig. 1. Clay-nodule with skull, pelvis, femur, and other bones of *Prophaethon shrubsolei* (type specimen). Natural size.

Fig. 2. Occipital surface of skull of *Prophaethon shrubsolei*. Natural size.

a.t., antitrochanter.
cb.p., cerebellar prominence.
f., femur.
i.o.s., interorbital septum.
i.o.f., interorbital fenestra.
il., ilium.
is., ischium.
jug., jugal.
l.s., surface for lachrymal.
m.t., mammillary tuberosities.
n., external nares.
n.g., narial groove.
oc.c., occipital condyle.
o.p., orbital process of quadrate.
p.o.p., postorbital process.
p.p., paroccipital process.
pu., pubis.
q., quadrate.
r., ribs.
r.h., rostral hinge.
s., sacrum.
sc., scapula.
sq., squamosal.
t., tibio-tarsus.
t.f., temporal fossa.

2. Note on the Proboscis Monkey, *Nasalis larvatus* (Wurmb).

By Stanley S. Flower, F.Z.S.

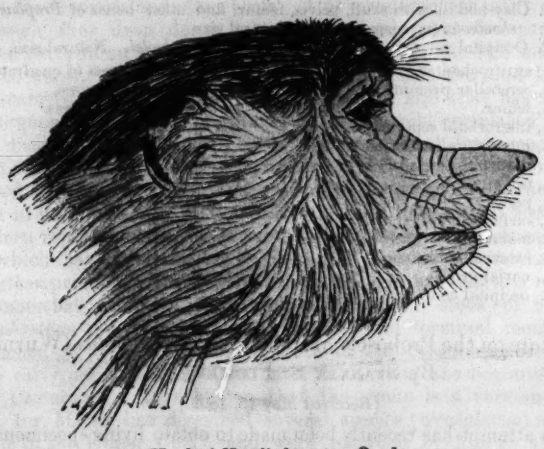
[Received May 15, 1899.]

An attempt has recently been made to obtain living specimens of the Proboscis Monkey, *Nasalis larvatus* (Wurmb), for the Egyptian Government's Zoological Gardens at Ghizeh. Through the kind intervention of Jonkheer P. J. F. M. Van der Does de Willebois, Agent and Consul-General for the Netherlands in Cairo, five individuals were procured in Borneo and despatched *via* Singapore for Egypt. Only three reached the Suez Canal alive, and were landed at Port Said in very poor condition, one dying within a few hours of being landed. The two survivors were kindly looked after by Sanieh F. Dixon Bey and sent by train to Cairo. They arrived at the Ghizeh Zoological Gardens on the evening of April 4, 1899, an adult female cold and apparently dead, and a young male looking ill and listless. Everything possible was done for them; the female revived for a time under the influence of a warm fire and a dose of gin, but died next morning; the male, however, rallied, and after some days got apparently quite well and active, but unfortunately died suddenly on May 4, 1899, having been just one month in the Gardens.

I send sketches of the profiles of these two animals (figs. 1 & 2, p. 786), taken from life.

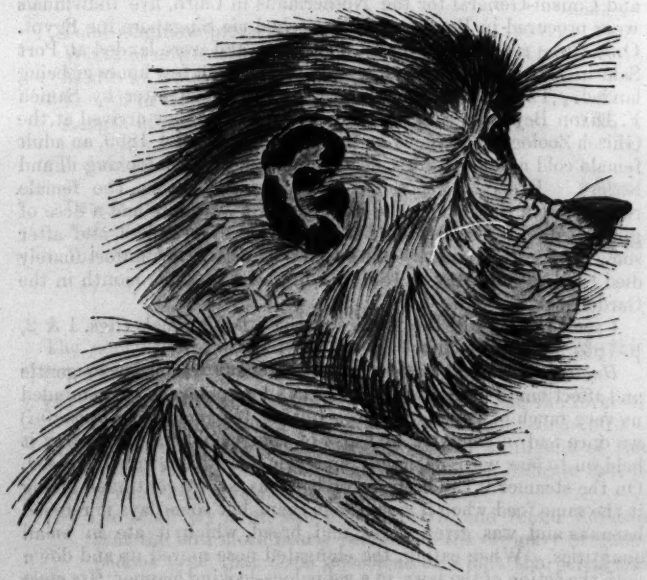
Habits. This young male Proboscis Monkey was of a very gentle and affectionate disposition and not at all mischievous; it reminded us very much of a young Siamese Lutong (*Semnopithecus germaini*) we once had in captivity, and also of young Gibbons, in the way it held on to one with its hands and evidently liked to be caressed. On the steamer it had been fed on bananas, so we continued giving it the same food when it would take them, but some days it refused bananas and was given dates and bread, which it ate in small quantities. When eating, the elongated nose moved up and down with the action of the jaws, in a ridiculous-looking manner. Its most curious habit was its fondness for water: when set at liberty in

Fig. 1.



Head of *Nasalis larvatus*, ♀ ad.

Fig. 2.



Head of *Nasalis larvatus*, ♂ jr.

the Gardens it would go straight to a pond, plunge boldly into the water and commence swimming; it swam slowly, but with facility and determination.

Colour. Iris dark brown; naked portion of face—♀ flesh-coloured; ♂ flesh-coloured, except the space between the eyes and the proboscis, which are purplish brown. Ears particoloured, black and flesh-coloured. Hands, feet, and ischial callosities black.

Hair, ♀. Reddish brown, bright chestnut on the top of the head, neck, and shoulders; underneath of head, neck, and body pale buff; a conspicuous white patch on the lower part of the back, forming a transverse diamond-shaped mark; tail white, the extreme tip being reddish buff.

Hair, ♂ (jr.). Much brighter coloured than the adult ♀. The upper parts are very bright yellowish chestnut, darkest on the top of the head; the lower parts are silvery buff; an irregular grey patch on the lower part of the back; tail silvery white at the base, gradually turning to brownish grey towards the tip.

Eyebrows, basal third red-brown, remainder black.

Hairs on the lips white.

Measurements.

	♀.		♂ juv.	
	in.	mm.	in.	mm.
Length, head and body	22	559	19	482
„ tail (without end hair)	24¼	616	18	457
„ „ (with „ „)	25½	648	18½	470
Fore limb	19¼	489	14½	368
Hind limb	21¼	540	16½	419
Girth beneath arms	13	330	8	203
Ear	1¼	32	1¼	32
Projecting portion of nose	1	25	¾	20
Hind foot	7¼	184	6	152

3. On the Temperature of the Ratite Birds.

By Alexander Sutherland, M.A.

[Received May 17, 1899.]

There is a large and fascinating chapter in the history of animal development which remains to be written, and lies as yet practically untouched. It is the story of the process by which the cold-blooded animals grew to be warm-blooded: or, to speak more definitely, it is the story of that adaption of the vaso-motor nerves and their centre in the medulla whereby, from a simple apparatus to regulate the flow of blood in the body to the parts where it happened to be needed, the whole system took on the more complicated function of regulating the temperature and keeping it at a high level most favourable to the animal's activity.

Before the story of that process can be written, many preliminary

years of observation will be necessary, and much gathering of facts such as, to a certain extent, Dr. Pembery has collected in the paper contributed by him to Schaefer's 'Physiology.' These will no doubt give an ultimate foundation for a satisfactory theory, which is as yet impossible.

Among these preliminary facts there must be many observations of the normal temperature of all species of animals, but more particularly of those birds and mammals which form the link between their own classes and the reptile class below them. Out in Australia, and under favourable conditions, I made, during two years, daily observations on the temperatures of monotremes and marsupials, and was able to show, in a paper published last year in 'Nature,' that those Orders which are structurally lowest, and therefore lowest in classification, are also lowest in temperature of all the mammals and form indubitably a chain of connecting-links between the cold-blooded and the warm-blooded condition. It is clear that up to a certain point increasing temperature has been a concomitant, perhaps a factor of general progress. Not, however, that the highest animal will always necessarily be the highest in temperature. Because, after a certain limit has been reached, progress is rather shown in perfecting the apparatus that secures a uniformity of temperature. For to all animals there is a limit beyond which it is fatal to go. A frog will begin to collapse at 32° C. (90° F.). A man is normal at 37°, but begins to collapse at 41°, and is beyond the hope of recovery if his temperature reaches 42° (107°·6 F.). Birds in general are normal about 42°, but perish at 45° (113° F.).

The process of development, therefore, is to carry an animal up to that temperature at which its metabolism will produce the most healthful activity, and, after that, to make the animal secure against dangerous variations from that standard. This process finds its perfection in man, who can sit with little inconvenience for an hour or two in an oven, where the heat would be such as to kill a rabbit in ten minutes.

Up to a certain point, however, the temperature of animals is closely concomitant with their rank in the zoological classification. The monotremes are the coldest-blooded of all mammals and the least able to maintain a uniform temperature, the lower genus, *Ornithorhynchus*, being also the less gifted in these respects. The other genus, *Echidna*, leads us a step higher and forms a link towards the lowest marsupials, among which family after family carries us steadily up to the characteristic mammalian temperature.

Having in a general way ascertained that this is the case with mammals, I was very anxious to do the same with birds, but have never had a chance until the Society's Gardens placed it in my way. Although the Apteryx, which structurally is the lowest of birds, is a native of New Zealand, I have never seen one in Australia on which to make observations. But on visiting London I received from Mr. Sclater and Mr. Bartlett courteous permission and a generous co-operation in taking the temperatures

of the three specimens now in the Gardens, and I wish to place on record in the 'Proceedings' of the Society that the Apteryx is the lowest in temperature of all birds, so far as yet has been recorded.

The following were the rectal readings:—

Mantell's Apteryx, male, 37°·4.
" " young male, 38°·2.
Haast's Apteryx, male, 38°·1.

The average is 37°·9 C. (100°·2 F.).

Next to the Apteryx in rank comes the Order Casuarii, comprising the Emus and the Cassowaries. Of the former I secured the temperature some years ago in Melbourne, through the kind assistance of my friend Mr. Ernest Le Souëf. The two specimens on which observations were made stood at almost the same level, 39° C. (102°·2 F.). I was very anxious to see how the temperature of the Cassowaries compared with this. The Hon. Walter Rothschild very readily and cordially granted me permission to make observations on three specimens which belong to him in the Society's Gardens. The largest (*Casuarius intensus*), a species, I believe, newly named by Mr. Rothschild, showed a temperature of 38°·8 C. The bird of medium size (*C. beccarii*) was at 39°·2 C.; and the smallest, the specific name of which, on account of its immaturity, had not been determined, indicated 39°. The average of the three was 39° C. (102°·2 F.), which is identical with that of the Emu.

For the Order which stands next (Struthiones), observations are as yet wanting, except two on the Ostrich, which are inconsistent and, as I think, not to be relied on.

But I have been more interested in going a step higher, out of the sub-class of the Ratitæ into the great sub-class of birds in general, called by Huxley the Carinatæ. The lowest order of the Carinatæ consists of the Crypturi, for which there existed no temperature records. By the courtesy of Mr. Bartlett, I was able to make observations on those in the Gardens and found a very decided step in advance.

Rufous Tinamou. 40°·8 C.
Spotted Tinamou. 39°·2 C.
" " Another specimen. 41°·3 C.
" " Third specimen. 41°·1 C.

These give an average of 40°·6 C. (105° F.), which brings them up to the lower limit of the range of temperatures usual for Anseres, Grallæ, and Gallinæ. For instance, in the case of fowls, I found that, over a long series of observation, their temperature, when they were lifted quietly off their perches by night, was on the average just at that level, 40°·6 C., but when lifted by day from the nests whereon they sat brooding their temperature averaged 41°·7 C. (107° F.).

There is another decided advance when we cross over among

the great orders of small and excessively active birds. The Passeriformes and Fringilliformes, with their allied orders, have an average temperature ranging from 42° to 44°.

Setting forth these results in a descending series, we find that:—

(1) The higher birds range about 43° C. (109°·4 F.).
(2) The middle birds range about 41° C. (105°·8 F.).
(3) The lowest birds range about 39° C. (102°·2 F.).

But these observations in the Society's Gardens show that Apteryx, the lowest order of all, is still lower in temperature, being only about 38° (100° F.).

The temperatures of the birds were all taken under uniform conditions, while the temperature of the air was between 55° and 63° F. And the result seems to bear out the contention, otherwise very probable, that the higher the bird in the zoological scale the higher in general is the temperature of its blood.

4. On the American Spade-foot (*Scaphiopus solitarius* Holbrook). By G. A. Boulenger, F.R.S.

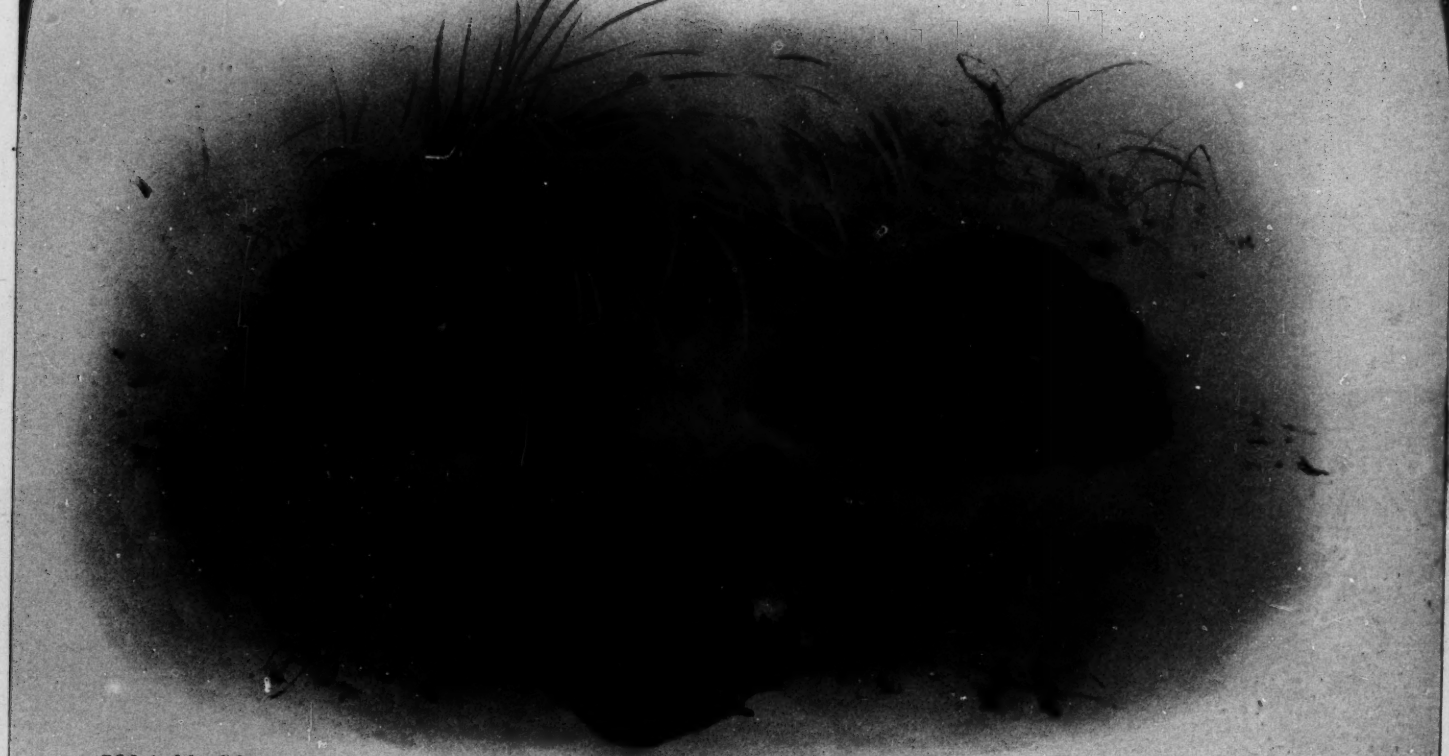
[Received May 25, 1899.]

(Plate LII.)

Remarks recently made by Dr. T. Gill[1] on the position of *Scaphiopus* in the family *Pelobatidæ* have induced me to make a detailed examination of the typical species of this genus, the osteological characters of which have not been fully described before. I was all the better prepared for this task, having had an opportunity of keeping and observing some living specimens, for which I am indebted to my friend Mr. A. Pam. These have enabled me to exhibit some figures of the animal carefully drawn and painted from life by Mr. P. Smit (see Plate LII.), the figures previously given by Holbrook and by Duméril and Bibron being very unsatisfactory and taken from spirit-specimens. I had at my command a good supply of the latter, as well as two prepared skeletons; but of the eggs and larvæ nothing was at hand, nor did literature afford any information on this head. I had applied last summer to Messrs. Brimley, in North Carolina, where the Spade-foot is abundant, who kindly informed me that the eggs are laid early in spring, in strings resembling those of toads, but thicker and with the vitelline spheres more irregularly disposed—in fact, as I infer, not unlike those of *Pelobates*. They added that the season was then too far advanced for tadpoles to be procured, as their development is comparatively rapid, and the pools in which they are reared dry up by the end of spring. I have therefore to postpone a description of the tadpole, which I hope, however, to supply ere long.

[1] Science, (2) viii. 1898, p. 935.

P.Z.S. 1899. Pl. LII.



P.J. Smit del. et lith.

Mintern Bros. Chromo.

SCAPHIOPUS SOLITARIUS.

BRITISH
130699
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Mr. C. S. Brimley writes from Rayleigh, N. Carolina, to the 'American Naturalist' (1896, p. 501):—"Last May I collected fifty breeding in a pool only a few yards from my house. In every case the grasp of the male was inguinal. The cry was not much louder than that of the common toad (*Bufo americanus*)."

The habits, so far as I have been able to observe them, are very similar to those of *Pelobates*. They burrow in the soil in exactly the same manner and come out only at night to feed. All my efforts to induce them to produce, when irritated, the loud cries so striking in *Pelobates* have failed. On the contrary, when teased, they assume a very humble appearance, bending down the head at an angle to the vertebral column and shutting the eyes in a manner which is well represented on the accompanying plate.

External Characters.

Vomerine teeth in two small, transverse or oblique groups on a level with the posterior border of the choanæ.

Tongue large, thick, circular, entire or feebly nicked and free behind.

Head large, convex, broader than long, with somewhat swollen occiput; crown and occiput rugose, the skin adhering to the bones; snout rounded, projecting slightly beyond the mouth; canthus rostralis rounded, lores very oblique; nostrils nearer the tip of the snout than the eyes, the distance between them half the width of the interorbital space, which exceeds the width of the upper eyelid; eye large, prominent, lateral; tympanum distinct, circular or vertically oval, two-thirds to three-fourths the diameter of the eye.

Fingers short, obtuse, third longest, first a little longer than second, fourth shortest; no subarticular tubercles; three round flat carpal tubercles forming a triangle, inner largest, at base of first finger, the two outer at the bases of the third and fourth fingers respectively.

Hind limbs robust and short, with swollen calves; the tibio-tarsal articulation reaches the shoulder or the tympanum; tibia shorter than the femur, the heels being widely separated from each other when the legs are folded at right angles to the rhachis. Foot longer than the tibia; toes short, obtuse, three-fourths or entirely webbed; no subarticular tubercles; a very large, compressed, sharp-edged inner metatarsal tubercle, longer than and in the axis of the inner toe.

Skin finely granulate or with small flat warts; black horny granules on the crown and occiput and on the warts of the body and limbs; a short, roundish or subtriangular, moderately prominent parotoid gland above the tympanum; lower parts smooth or feebly granulate; a roundish flat gland usually present on each side of the breast.

Brown or dark olive above, uniform or with more or less distinct darker marblings and often with a lyre-shaped pale brown or sulphur-yellow, dark-edged band on the back, the branches widest

apart on the sacral region; tympanum usually yellow. Some specimens, from Florida, whitish, handsomely marbled with dark brown (*S. albus* Garm.). Lower parts white, carneous under the thighs; metatarsal tubercle and tips of inner toes black.

Iris brassy yellow or golden, veined with black, or with a black transverse bar forming a cross with the vertical pupil.

Male with an internal vocal sac, opening into the mouth by a slit on each side of the tongue. Inner side of the two or three inner fingers, during the breeding-season, with bands of black asperities.

Measurements (in millimetres).	♂.	♀.
From snout to vent	67	73
Length of head	20	22
Width of head	28	29
Diameter of eye	8	8
Interorbital width	7	9
From eye to nostril	5·5	6
„ „ „ end of snout	10	12
Fore limb	33	36
Hind limb	72	78
Tibia	20	22
Metatarsal tubercle	5	6
Inner toe (from tubercle)	4	5

Skeleton.

Skull strongly ossified, studded with granular asperities above and at the sides. Nasals large, in contact along their entire length, and joining the fronto-parietals, the ethmoid being entirely hidden above; fronto-parietals broad, expanded into obtusely angular wings at the posterior borders of the orbits; squamosals with the zygomatic process enlarged, plate-like, and suturally united with an ascending process of the maxillary. Ethmoid produced forwards, confluent with the ossified nasal capsule, nearly reaching the præmaxillaries; vomers moderately large, narrowly separated from each other; palatines strong; parasphenoid T-shaped, not reaching to between the palatines; pterygoids extending forwards to the palatines, their inner branch joining the parasphenoid. A well-developed columella auris. Teeth with very obtuse, rounded crowns.

Mandible with the mento-meckelian distinct on the inner side only.

Hyoid apparatus not unlike that of *Pelobates*, with detached cornua and a fenestra on each side, but the anterior processes are not turned inwards, or, rather, they may be regarded as absent, the anterior fenestrated portion of the hyoid representing the anterior portion of the ceratohyal cornu fused with the lateral wing[1]. The postero-lateral process is elongate and the ossified thyrohyals are in contact at the base.

[1] See Ridewood, P. Z. S. 1897, p. 577.

Vertebral column twice as long as the skull. Vertebræ procœlous; neural arches covering each other, with a low crest and a short posterior process; the three anterior diapophyses long, the first directed forwards, the second horizontal, the third directed backwards; the following diapophyses short, the sixth and seventh slightly oblique, directed forwards. Sacral vertebra with strongly dilated diapophyses, which are subtriangular and a little broader than long. Urostyle as long as the seven anterior vertebræ and fused with the sacral.

Coracoids and præcoracoids strongly curved, connected by an arched cartilage; præcoracoid not entering glenoid cavity; no omosternum; sternum a large cartilaginous plate. Suprascapular nearly entirely ossified. Humerus once and a half as long as radius-ulna. Seven bones in carpus, three in contact with radius-ulna; two bones to the pollex.

Pelvis three-fourths the length of the vertebral column. Pubis cartilaginous. Femur feebly curved, longer than tibia, which is twice as long as astragalus and calcaneum. Three small bones in second row of tarsus, and a very large præhallux formed of two bones. Distal phalanges obtuse.

	millim.
Length of skull	20
Breadth „	26
Vertebral column	41
Humerus	18
Radius-ulna	12
Manus	14
Pelvis	30
Femur	24
Tibia	20
Tarsus	10
Pes	22

The result of this examination of the osteological characters is that, as pointed out by Gill, Cope was quite mistaken in placing *Scaphiopus* together with *Pelobates* in a group opposed to that containing *Pelodytes*. In spite of a certain resemblance due to convergence through similarity in their mode of life, *Scaphiopus* shows no very near affinity to *Pelobates*, and the relation of the latter to *Pelodytes* is unquestionably much closer. On the other hand, the propriety of uniting the three genera in one natural group (*Pelobatidæ*) is fully confirmed, as are, in fact, most of the groupings into higher groups proposed by the illustrious American naturalist in dealing with the classification of the Tailless Batrachians in 1865.

EXPLANATION OF PLATE LII.

Scaphiopus solitarius, drawn from life in three attitudes.

5. On a West-African Kob Antelope.

By R. Lydekker.

[Received June 1, 1899.]

(Plate LIII.)

Among a series of specimens from Sierra Leone recently offered for purchase to the Natural History Museum are the skull and skin of a small female Kob (Plate LIII.) which do not agree with those of any species of the genus *Cobus* hitherto described. The entire specimen was obtained, together with examples of *C. cob*, between the Great and Little Scarcies Rivers, in the Sierra Leone Hinterland.

The skull, which is slightly larger than that of the female Kob described as *Cobus senganus*, indicates an adult animal. And since it presents all the characters of the skull of the above-named genus, while the skin is likewise similar in general characters to the pelage of other Kobs, the serial position of the animal may be taken for granted.

In size this Kob was approximately the same as the Senga Kob, or Buffon's Kob; and it evidently belongs to the same subsection of the genus. From the Puku and Senga Kob (or Puku) it is distinguished by the black on the front surface of the fore legs and the lower portion of the hind pair; the hair also is shorter.

The markings and plan of coloration are very similar to those of *C. cob*, but, instead of being uniformly foxy, the general colour of the middle of the back is dark chocolate-brown, gradually turning into tawny on the flanks, and thence into the dirty white of the abdomen. The leg-markings are similar to those of *C. cob*, the white rings on each fetlock being very distinct. There is also a similar white ring round the eyes. The hair on the withers and lower part of the neck is reversed.

So far as I can see, the skin indicates an animal closely allied to *C. cob*, but distinguished markedly by its colour. As the skin is not mounted, it is impossible to ascertain whether any differences in addition to coloration distinguish the two. But since I am not aware of the prevalence of melanism as an individual character of foxy antelopes, it appears highly probable that the skin and skull under consideration indicate an undescribed form. Whether the difference be of specific or subspecific value, it is hard to say; but, assuming its right to distinction, the form represented by the aforesaid skull and skin may be named *Cobus nigricans*.

I may add that among the same collection are also specimens of *C. cob*, a species of which the Museum has hitherto had no adult examples.

I may likewise take this opportunity of mentioning that Mr. R. T. Coryndon has lately presented to the Museum male and female skins of a Kob from Barotse-land which I identify with *C. senganus*, described on the evidence of a female skull and skin obtained on the upper Loangwe river, westward of the northern end of Lake

J. Smit del. et lith.

Mintern Bros. imp.

BROWN FEMALE KOB FROM SIERRA LEONE.

J.Smit del. et lith.

Mintern Bros. imp.

THE LEOPARD OF THE CAUCASUS.

Nyasa. The female has been mounted, and agrees generally with the description of the type. Thus, contrasted with a typical female Puku, it is of smaller size, with the crown of the head blackish, more black on the ears, and the general colour of a deeper red. There are, however, whitish rings on the fetlocks, which are stated to be absent in the type. The male apparently differs from the typical Puku chiefly in its smaller dimensions, the head and ears not showing an increase of black.

As Barotse-land is not very far from the upper Loangwe valley, there is no reason why the same form of Antelope should not inhabit both localities; and I cannot regard the above-mentioned difference in respect to the light rings on the fetlocks as of more than individual or local importance. In all characters the animal is essentially a Puku, of which I regard it merely as a subspecies, and accordingly prefer to call it the Senga Puku, *C. vardoni senganus*, instead of *C. senganus*.

6. On the Leopard of the Caucasus. By R. Lydekker.

[Received June 5, 1899.]

(Plate LIV.)

In his recently published work entitled 'Hunting Trips in the Caucasus,' Prince Demidoff states that the Snow-Leopard (*Felis uncia*) occurs in the Caucasus; and he figures (p. 85) an animal which is undoubtedly that species. I am informed, however, that the specimen from which that figure was taken is not of Caucasian origin. And as I find that Dr. Satunin[1] especially denies the occurrence of the Snow-Leopard in the Caucasus, I have endeavoured to make out what animal had been mistaken for it.

Dr. Satunin records the occurrence of the ordinary Leopard in the range, but without stating whether Caucasian examples differ from ordinary Indian Leopards on the one hand or from African Leopards on the other. But since the so-called *Felis tulliana* of Valenciennes occurs in Asia Minor[2] and also in Persia[3], and bearing in mind the approximation to the Ounce exhibited by that variety of the Leopard, nothing would seem more likely than it should also be found in the Caucasus.

In confirmation of this view, I have recently received through the good offices of Messrs. Rowland Ward, Ltd., a Leopard-skin from the Caucasus belonging to Prince Demidoff.

Compared with an ordinary Indian Leopard this skin (Plate LIV.) is at once distinguishable by the irregular formation and small size of the rosettes, in which the centres are not appreciably darker

[1] Zool. Jahrb., Syst. ix. p. 290 (1896).

[2] See Danford and Alston, P. Z. S. 1880, p. 51.

[3] See Blanford, 'Fauna of British India,' Mamm. p. 69 (1888); the so-called Ounce skins referred to by the same author in his 'Eastern Persia,' vol. ii. p. 35 (1875), also doubtless belong to the form described as *F. tulliana*.

than the general ground-colour. Moreover, from the head to the shoulders the spots are solid, like those of the Hunting-Leopard. In their large size, oblong or circular form, and wide separation from one another, they are quite unlike the spots on the same part of the body of the African Leopard, which are also solid.

The fur, which is relatively long all over the body, becomes still more markedly so on the under-parts, where it is pure white, with solid elongated black spots of very large size, but widely separated from one another. In this respect the skin is nearer to the Indian than to the African Leopard, in which the fur of the under-parts is yellowish, with the spots so large as to exhibit only a network of light ground. The resemblance of the under-parts of the present specimen to the corresponding region of the Snow-Leopard is remarkably striking; and a similar resemblance is exhibited by the very long and bushy tail, especially the terminal third, which is black and white only.

That the present specimen is, however, only a well-marked local variety of the Leopard I am quite convinced; and if I am right in identifying it with the so-called *Felis tulliana*, the latter animal must also be looked upon as a race of the same species, under the title of *F. pardus tulliana*. This will accordingly be the North-eastern representative of the species; and it will be interesting to find where it passes into the ordinary Indian form, to which it is clearly nearer than it is to the African. It is stated by Mr. Blanford to range into Baluchistan and the confines of Sind.

I may add that I am fully convinced of the advisability of separating the Indian from the African race of the Leopard; but there comes the puzzling question as to which is entitled to bear the name of *typicus*.

7. On the supposed former Existence of a Sirenian in St. Helena. By R. Lydekker.

[Received June 12, 1899.]

In no zoological nor distributional work[1] with which I am acquainted can I find any reference to the alleged occurrence of a Manati in St. Helena. Nevertheless, there are records to the effect that an animal going by that name formerly inhabited that island. For example, Mr. J. C. Melliss, in his work on St. Helena[2], definitely states that a Manati once occurred there, and goes so far as to express his opinion that it was specifically identical either with *Trichechus americanus* or *T. senegalensis*. I am also informed by my friend Mr. R. A. Sterndale, now Governor of the island, that Manatis were formerly of such frequent occurrence that there was a regular government duty on each one killed.

[1] Both Mr. Wallace in 'Island Life' and Messrs. Sclater in the 'Geography of Mammals' are silent on this subject.

[2] 'St. Helena: a Physical, Historical, and Topographical Description of the Island.' London, 1875, pp. 86 & 87.

In answer to my enquiries, Mr. Sterndale wrote to me as follows on the subject[1]:—"The last appearance recorded of the Manati in St. Helena was in 1810, when one came ashore at Stone Top Valley beach, and was shot by a Mr. Burnham. It measured seven feet, and ten gallons of oil were obtained from it. Another was seen the same year in Manati Bay.

"In the old records I find, March 20, 1690, it thus entered—'Tuesday, Goodwin and Coales brought up for killing a Sea-Cow, and not paying the Company's Royalty. They desire pardon, and say the Sea-Cow was very small; the oyle would not amount to above four or five gallons.'

"Again, on the 11th September, 1739, 'A Sea-Cow killed upon Old Woman's Valley beach, as it was lying asleep, by Warrall and Greentree.'"

This evidence, I take it, may be regarded as amply sufficient to prove the former occurrences of a marine mammal at St. Helena. And from the name "Manati Bay" given to a spot on the S.W. coast, it further seems evident that the animal in question was far from uncommon; although, on the other hand, it never seems to have been abundant. In addition to this, the name of the bay, and the application of the title Manati or Sea-Cow to the animal itself, seem to be evidence in favour of the Sirenian nature of the latter; for, so far as I am aware, such names are not misapplied in popular language to Seals. And there are no Seals known from the island. Moreover, if the creatures in question had been Seals they would almost certainly have been numerous, while they would not have been exterminated so easily. Against the Sirenian nature of the animal may, however, be urged the mention of the killing of a specimen asleep on the beach, since it is generally stated that there is no decisive evidence that Sirenians ever voluntarily come ashore[2]. Too much importance must not, however, be attached to this, seeing that it is, in the first place, mainly negative evidence, while, in the second place, it might not be applicable in the case of an extinct species, with which we may have to do in this instance. It decisively shows that the animal was not a Cetacean.

With regard to the idea of the St. Helena animal being identical with either the African or the American Manati, it appears to me that this is impossible. In the first place, although it is conceivable that an individual might once and again be carried from either shore to the island, it is quite out of the question that this could have been a case of common occurrence. And, accordingly, if the creature were a Sirenian at all, it must have been a denizen of the coast of the island. But such a coast, without a single river-mouth or estuary, would have been quite unsuited to the habits of Manatis, as we now know them. A Dugong might perhaps live there; but then there is no evidence of the existence of those animals in the Atlantic.

If, then, the St. Helena animal were a Sirenian at all (on which

[1] The same extracts in a rather briefer form are given by Melliss.
[2] See Flower and Lydekker: 'Study of Mammals,' p. 214.

point I do not wish at present to express a definite opinion), the probability is that it was at least an extinct species, if not a genus.

Could the existence of a St. Helena Sirenian be definitely determined, it would be of much interest in regard to the history and distribution of the group. Mr. Sterndale, who is convinced that the creature was a "Manati," has promised to make a thorough search in the island for any remains that may have escaped destruction; but I fear that any successful results are in the highest degree improbable. The best chance would be to thoroughly examine the shore at Manati Bay, especially if there are any raised beaches.

8. On the Brain of *Hydrochœrus*. By Frank E. Beddard, M.A., F.R.S., Prosector and Vice-Secretary of the Society.

[Received June 6, 1899.]

In a communication made to this Society some years since [1] I dealt with the cerebral convolutions of a considerable number of genera of Rodents. Among the more important types which I was unable to study on that occasion was the genus *Hydrochœrus*. I was able, however, to refer to a published description of this genus accompanied by illustrations by M. Camille Dareste. Inasmuch as *Hydrochœrus* has the largest and best convoluted brain of any Rodent [2], and as I have been able to study three excellently preserved brains extracted from specimens which have died in the Gardens, I think it worth while to add what I find myself in a position to do to Dareste's relation and interpretation of fact.

That author had two brains at his disposal, but has only figured the dorsal aspect of one. His paper also contains figures of a lateral and a ventral view.

General External Features of the Brain of Hydrochœrus.

M. Dareste has represented fairly accurately the external features of the brain, save for one particular: I find that in my well preserved brains there is no such hiatus as he figures between the cerebral hemispheres and the cerebellum. The somewhat pointed anterior end of the cerebellum fits in fairly closely between the divergent extremities of the cerebral hemispheres. Moreover the general outline of the hemispheres is by no means so triangular as he has represented it to be. It is indeed almost a hexagon, of a much more graceful figure.

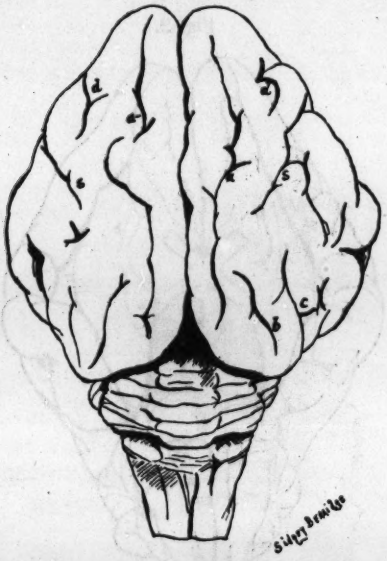
As to the under surface: one of my specimens, which was in an exceptionally perfect state of preservation, enables me to add to Dareste's description and, I believe, improve upon his figure.

[1] "On the Convolutions of the Cerebral Hemispheres in certain Rodents," P. Z. S. 1892, p. 596.

[2] "Note sur le Cerveau des Rongeurs, &c.," Ann. Sci. Nat. (4) iii. p. 355.

The rhinal fissure separating the hemispheres from the underlying pallium is very strongly marked. It does not quite reach the anterior end of the brain, so that here the pallium seems to bend down and become perfectly continuous with the underlying lobe.

Fig. 1.



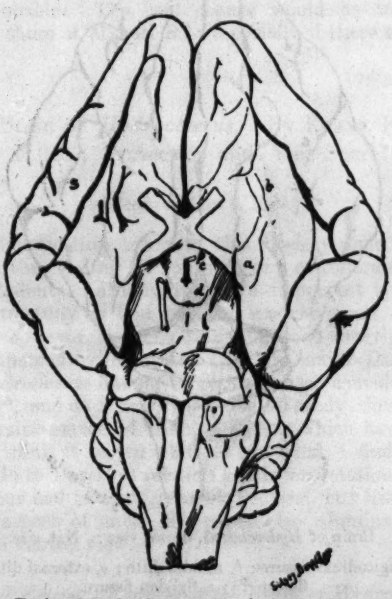
Brain of *Hydrochœrus*, dorsal view. Nat. size.

a, internal longitudinal fissure; *b*, middle ditto; *c*, external ditto; *d*, crucial fissure (?); *s*, Sylvian fissure.

Dareste draws attention to two structures on the ventral side of the hippocampal lobe which are thus described:—"En dedans de cette circonvolution est un sillon qui délimite le petit appareil des corps striés et des couches optiques qui est ici très développé." I find these structures to be shown with great clearness in the brain now before me (fig. 2, *a*). They are, however, rather longer in form than they are figured by the authority from whom I have just quoted. Nor have they, as erroneously represented in the figure of Dareste, anything whatever to do with the origin of the optic nerves. The latter can be plainly seen to dip down over the outer side of the crura cerebri. On the other hand, one of the principal roots of the olfactory nerve does arise from this delimited area of brain-tissue, a fact which is not figured or referred to by Dareste. This point should be perfectly clear from the drawing exhibited (fig. 2).

Behind the optic chiasma is a large somewhat heart-shaped elevation (*c*, *d*). It is divided anteriorly by a median furrow which is well-marked and deep; behind it shows indications of division into two. This elevation appears to me to be the tuber cinereum and the corpora albicantia partly fused, but whose independence is still to be recognized on a careful examination.

Fig. 2.



Brain of *Hydrochærus*, ventral view. Nat. size.

s, pallium; *b*, olfactory nerve; *a*, origin of same; *c*, tuber cinereum; *d*, corpora albicantia; *p*, pituitary body.

Other features to be noted on the ventral surface of the brain will be seen by an inspection of the accompanying drawing.

Fissures of the Hemispheres.

I shall take as an assumed normal the best preserved of my three brains, indicating the divergences in arrangement which the others show.

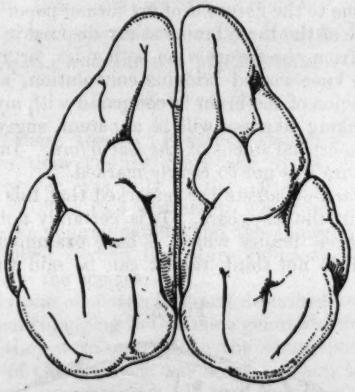
The most salient fissure is that lettered *a* (fig. 1). It runs almost from end to end of the brain; at about the middle of its course it is bulged out on either side, and on the left side it is just interrupted by a bridging convolution, and is thus divided into two

parts, an anterior shorter, and a posterior longer region. It is the fissure lettered *a* of my former paper—the most prevailing fissure of the Rodent brain.

In a second brain (fig. 2, p. 800) the fissure in question is also broken on the left side by a bridging convolution, in this case on the right side also, as is the case with the brain figured by Dareste. It will be noticed that this furrow posteriorly approaches the median furrow of the brain, that dividing the hemispheres, and is very nearly lost to sight over its edge.

In the third brain (fig. 3) the furrow *a* is again broken on the left side, but complete upon the right. Furthermore the furrow (fig. 3) completely disappears from view posteriorly, and this region of the gyrus, which is bounded externally by the furrow in question, is very distinctly depressed below the general surface of the brain.

Fig. 3.



Cerebral hemispheres of *Hydrochærus*, dorsal view. Nat. size.

The conditions that have just been described seem to give a clue to the nature of this sulcus and gyrus. The lobus hippocampi narrowing as it passes backward turns up the back of the brain and becomes continuous with this gyrus, which I therefore consider to be the hippocampal gyrus appearing upon the dorsal surface of the brain. In this feature the brain of the Capybara resembles that of certain Carnivora [1] and of certain Ungulata [2].

The fissure which I letter *b* is, as in other Rodents, short; it is, however, quite deep and well-marked. It runs obliquely inwards in all three brains.

[1] *Heliotis* (Garrod, P. Z. S. 1879, p. 307); *Gulo* (Beddard, P. Z. S. 1895, p. 143), &c. &c.

[2] *Moschus* (Flower, P. Z. S. 1875, p. 174); *Dicotyles* (Turner, Journ. Anat. 1891, p. 134), &c. &c.

The third fissure *e*, which runs parallel or approximately so to the last, is also a perfectly constant fissure in the Capybara's brain.

The temporal lobe has further other slight fissures which are so irregular that I think it hardly worth the trouble of describing them.

Fig. 4.

Brain of *Hydrochærus*, inner view of hemispheres.

Now we come to the fissure *d* of my former paper on the Rodent's brain. In one of the three brains at my disposal it passes outward and forward from the fissure *a* on both sides, or rather from the margin of the knee-shaped bridging convolution, already referred to. If this region of the brain be compared with my figure of that of *Gulo*, a striking likeness will be apparent, suggesting that the fissure *d* is the crucial sulcus of the Carnivora. In the two other brains the fissure was not so clearly marked.

Sylvian fissure.—Dareste has remarked that this fissure appears to be absent in the Capybara. It is certainly not at all plain in any of the three brains which I have examined myself. But nevertheless I do not think that it can be said to be totally un-

Fig. 5.

Brain of *Hydrochærus*, inner view. Nat. size.
A, calcarine (?) fissure; B, C, parieto-occipital; E, calloso-marginal.

represented. On viewing all these brains from the dorsal aspect, a prominent and obliquely (or, in one case, transversely) running fissure is to be seen which separates off the wider posterior region of the hemispheres from the anterior narrower portion (fig. 1, *s*). It coincides, in fact, in position and direction with what seems to be undoubtedly the Sylvian fissure in *Lagostomus* (P. Z. S. 1892, p. 599,

fig. 2, A & B), but it does not reach the margin of the pallium. It is, however, always very near to reaching this margin; and on one side of one brain it appeared actually to do so through becoming confluent with another fissure of short length.

On the mesial surface of the brain a single fissure (fig. 5, E) is very plain anteriorly, which curves round the anterior end of the corpus callosum. This is the limbic fissure of Broca, splenial of other authors, and, I presume, calloso-marginal of still others. A very interesting little fissure was observable in the best preserved of the two brains which I bisected longitudinally. This is shown in fig. 5. At the end of the hemisphere is a short vertical fissure (A, B, C) and a shorter one still behind this, and a more faintly marked one in front. It is of course an obvious suggestion that they are the parieto-occipital and calcarine respectively.

9. Notes upon two Earthworms, *Perichæta biserialis* and *Trichochæta hesperidum*. By Frank E. Beddard, M.A., F.R.S., and Sophie M. Fedarb.

[Received June 6, 1899.]

The first of these species (*Perichæta biserialis*) was originally instituted more than twenty years ago by M. Perrier[1], whose description, however, was only in the nature of a "preliminary communication." The two matters to which he referred, viz. the disposition of the genital papillæ and the enlarged setæ on either side of the ventral median line, were sufficient at that time to fully differentiate the species.

Subsequently one of us received and described[2] some specimens of an earthworm belonging to this same genus also from the Philippine Islands; they were referred to the same species, though the entire absence of spermathecæ was noted. Upon this latter point Perrier made no observations. It was therefore concluded that it would be better to regard the worms described as being of a different species. In the 'Monograph of the Oligochæta' therefore they were described under the name of *Perichæta acystis*. Since then Michaelsen[3] has re-described *Perichæta biserialis* very fully, and more recently still Dr. Horst[4].

Dr. Horst, whose observations where published after ours were made, examined eight mature worms from Paramaribo in Dutch Surinam: "of these two have four pairs of copulatory papillæ on

[1] "Sur les Vers de terre des Philippines et de la Cochinchine," Comptes Rendus, 1875, p. 1043.

[2] F. E. Beddard, "Observations upon an American Species of *Perichæta*, &c.," P. Z. S. 1890, p. 63.

[3] "Die Terricolen des madagassischen Inselgebiets," Abh. Senck. nat. Ges. xxxi. (1897) p. 226.

[4] "On the Variability of Characters in Perichætidæ," Notes Leyd. Mus. xx. p. 201.

segments xix.–xxii.; three of them show only three pairs on segments xix.–xxi.; one specimen has three papillæ on segments xix.–xxi. on the right side, and on segments xx.–xxii. on the left, while on both remaining forms one has only three papillæ at the right, the other one at the left side of the body on segments xix.–xxi."

The spermathecæ also are varied. Only one individual had a pair in each of segments vi. and vii. Four others had no spermathecæ at all. In the three others they were asymmetrical and as many as 3 and 5 on one side of the segment.

As our series of variations is more extensive than those recorded by Dr. Horst, we think that it will be worth while to record them. It is conceivably a noteworthy point that our specimens come from the New World, but we do not wish to lay more stress upon this fact than it will bear.

The present communication deals with 18 mature examples of an earthworm from British Guiana, which were received through the kindness of Mr. Cecil Lilley, and which show conclusively that there is no need for the retention of the species *P. acystis*. It seems to be undoubtedly identical with *P. biserialis*.

The worms were so much softened by the spirit in which they were preserved that it seems to be of no great use to give an attempt at accurate measurement of length. To mention that one specimen actually measured 475 mm. would be to give quite an erroneous idea of its size when in a moderate degree of contraction. It may be taken that these individuals were of about the same dimensions as the examples examined by Michaelsen.

The number of segments in a fair-sized specimen was 190.

The dorsal pores, as in Michaelsen's specimens, commenced between segments xii./xiii.

The setæ of this species, as already mentioned, are remarkable for the fact that the two on the ventral median line on either side of the nerve-cord are considerably larger than the others. Furthermore, the setæ of the anterior segments are all or most of them larger than those on the posterior segments, and in segments v.–viii. the four most ventral setæ are larger than the others and increase progressively up to the 7th. The setæ appear to be, for the most part, absent upon the clitellum; but in one specimen, at any rate, there was a single seta on each side of the middle ventral line of the sixteenth segment. The question of setæ upon the clitellar segments of *Perichæta* is one which requires a renewed consideration. It has been common to use the presence or absence of setæ as of specific value, but it seems to be possible, from the variations which have been recorded in some species, that setæ are really not finally present upon the clitella of many species where they exist for a short period after the formation of the clitellum. As development proceeds they drop out.

In a selected series of segments the numbers of the setæ are as follows—ii. 42, v. 60, x. 76, xii. 64, xvii. 55, xix. 60, xxiv. 60.

A few may of course have been omitted owing to their having fallen out and their apertures not noticed.

The clitellum itself seems not to occupy quite fully the first and the last of its three segments.

The second characteristic feature of this species is the arrangement and the numbers of the genital papillæ. These papillæ are paired and follow the 28th segment. The greatest number of pairs found in our examples was 5; the following numbers were also observed: 4 pairs, 3 pairs; 5 right side 4 left, 3 right 4 left, 4 right 3 left, 4 right 6 left. Perrier found as many as 7 pairs; Michaelsen not more than 5, as was the case with us.

This asymmetry of the genital papillæ, which is not by any means a novelty any more than is the varying number of pairs in individuals, is coupled with an irregularity and asymmetry of the spermathecæ. It is mainly upon this matter that we desire to lay stress in the present communication.

In first of all describing the species *Perichæta acystis* the author recorded, without commenting upon the fact, that papillæ were also present. Now in species without spermathecæ there are, as a rule, no papillæ. Not many examples occur among earthworms of species which are without these characteristic Oligochætous organs; but there are a few, among them being two species of the present genus. Dr. Rosa[1] has described *Perichæta atheca*, and Dr. Michaelsen[2] *Perichæta barami*. In the first mentioned there are no genital papillæ; in two individuals of the latter the papillæ were reduced or absent. In species of *Allolobophora*, on the other hand, there are no spermathecæ, such as *A. eiseni*, there are also no tubercula pubertatis.

Of *Perichæta atheca* Rosa examined several individuals, so that there the coincidence of absent genital papillæ and missing spermathecæ seems to be absolute. In *Perichæta biserialis*, on the other hand, spermathecæ are sometimes absent and sometimes present. Perrier makes no mention of the matter at all in his brief account of the species. Michaelsen had five examples, all of which possessed two pairs of these organs in segments vi. and vii.; the number of genital papillæ varied, as already said.

The two specimens which formed the material upon which the species *Perichæta acystis* was established had each five pairs of genital papillæ and no spermathecæ. In the present collection there are 12 specimens without and 6 with spermathecæ; but no ascertainable relation exists between the condition of the papillæ and that of the spermathecæ. We may fairly put aside *Perichæta atheca* for two reasons. In the first place, it may still be that the species is, like *P. biserialis*, sometimes with and sometimes without spermathecæ, and also for the reason that an absence of genital papillæ is so general or at least so common among *Perichæta* that it need have no significance in connection with the absence of spermathecæ. The absence, then, of any connection between

[1] "I Lombrichi raccolti a Sumatra dal dott. Elio Modigliani," Ann. Mus. Civ. Genova, xxxvi. p. 520.

[2] Oligochaeten: from Kükenthal, "Ergebnisse einer zoologischen Forschungsreise in den Molukken und in Borneo," Abh. Senck. nat. Ges. xxiii. p. 203.

genital papillæ and spermathecæ in *Perichæta* and the existence of such a connection in Lumbricidæ seems to show that physiologically the genital papillæ of *Perichæta* are different from the tubercula pubertatis of the Lumbricidæ.

Out of our examples only six had spermathecæ, and in every one of these individuals the arrangement of these was asymmetrical.

Fig. 1.

Spermathecal segments of *Perichæta biserialis*.
SP., spermathecæ; N., nerve-cord.

The following is a tabulated statement of the number and arrangement of the organs in question:—

	Segment vi.	Segment vii.
Ex. 1	3 left, 0 right.	4 left, 0 right.
Ex. 2	1 left, 0 right.	1 left, 1 right.
Ex. 3	3 left, 3 right.	0 left, 1 right.
Ex. 4	0 left, 0 right.	0 left, 1 right.
Ex. 5	0 left, 0 right.	0 left, 1 right.
Ex. 6	0 left, 2 right.	1 left, 1 right.

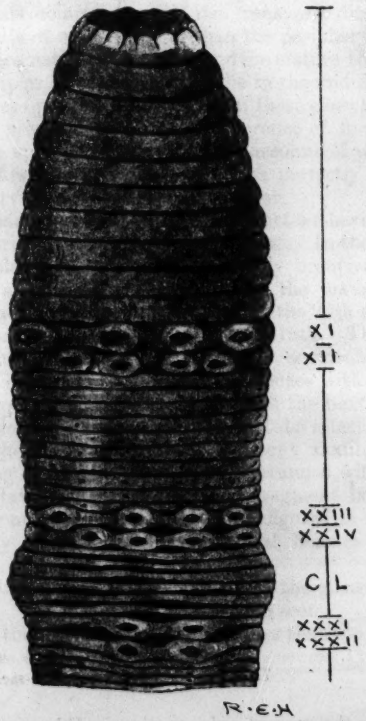
In defining the species, then, ought one to regard the presence, and if the presence, the irregularity, or on the other hand the absence, of spermathecæ as a specific character? Some variations in structure among earthworms have been already noticed; but there is only one case (perhaps two) which is so striking as that to which

we have called attention in the present communication. Those are the two species *Perionyx excavatus* and *Perichæta indica*. But in the case of the former species the number of what we may there fairly term abnormal specimens was small in proportion to those which were normal; only 18 out of about 430. In *erichæta indica* the occasional absence of the "prostate" gland is more frequent.

Trichochæta hesperidum.

The genus *Trichochæta* was founded by one of us some years since[1] and two species were described.

Fig. 2.



Trichochæta hesperidum, ventral view of anterior segment.
CL, clitellum.

[1] Beddard, "Two new Genera and some new Species of Earthworms," Quart. J. Micr. Sci. xxxiv. p. 252; and "On some new Species of Earthworms from various parts of the World," P. Z. S. 1892, p. 701.

A few specimens of this genus have been recently received from Kew Gardens through the kindness of Mr. Nicholson. Their native place is Jamaica. They evidently belong to the species *Trichochæta hesperidum*. In the description of that species there are a few lacunæ. Some of these can be filled up by additional facts derived from a study of these fresh specimens. The original,

Fig. 3.

Trichochæta hesperidum, sperm-sac.

and up to the present only, specimen of the genus was not mature. Some of the worms which we refer to in the present communication were fully mature. We are able therefore to map the clitellum, which was not developed in the former specimen.

This modified region of the integument occupies six segments,

extending from the 26th to the 31st segment. The modification of the integument, however, is only ventral; it does not die away gradually, and there is a sharp demarcation from the dorsal surface which is unmodified. The boundaries of the segments could be noticed with perfect ease in this region. The setæ, however, were not obvious.

Another external feature of some little importance, which was observed, is the presence of papillæ. They are situated ventrally, but are not perfectly symmetrical in their arrangement, inasmuch as they correspond to setæ which are themselves in this species scattered after the fashion of *Pontoscolex* and some other Geoscolecids. Of these papillæ there are 4 on each of segments xi., xii., xxiii., xxiv., and 2 on each of segments xxxi., xxxii. They are oval in form, the long axis coinciding with the transverse diameter of the body; the middle of each is higher than the periphery.

These papillæ were naturally plainer upon the mature than upon the immature examples. The setæ which lie in the middle of the areas formed by these papillæ are larger than those elsewhere, but do not appear to present any marked difference of form. We should add that the spiny tip of the setæ, on account of which the generic name was first bestowed, is not always perfectly obvious; but this may be very likely due to wear and tear.

As to internal characters, the main addition that we have to make to the original description concerns the sperm-sac. In the original non-mature example these, though long, only occupied 15 or 20 segments. In an immature example from the material now before us the sperm-sac passed back to as far as the 90th segment; in a mature example much farther, to the 119th. They thus occupy in the latter case no less than 109 segments. Their structure is thus: in segment xi. the sac commences with a dilated pouch, flattish, bigger ventrally than dorsally; in the next segment they are thinned down to a fine thread-like tube attached to the lateral walls of the intestine. About segment xxxiii. the sac dilates into a string of irregular-shaped sacs arranged without any regard to segmentation. Somewhere about segment lxxv. these irregular sacs bear numerous processes, as was figured in the paper in the 'Quarterly Journal of Microscopical Science' already referred to.

There are six thickened septa lying behind the gizzard (which is in segment vi.). No calciferous glands were seen.

We should add that the mature worm is larger than the originally described immature example. One of ours measured 113 mm. by 5 mm. in diameter.

10. On a small Collection of Butterflies sent by Lieut.-Col. A. S. G. Jayakar, A.M.S., from Muscat. By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c.

[Received June 19, 1899.]

For some years past the collections in the British Museum have been enriched through the zeal of our Corresponding Member, Dr. Jayakar; but, until the arrival of the last consignment, no Lepidoptera have come to hand: in this one, however, several small packets were included, amongst which were examples of nineteen species of Butterflies.

As our knowledge of the fauna of Arabia is still far from complete, it seems worth while to publish a list of the Butterflies now sent.

Of the nineteen species of which examples were obtained by Dr. Jayakar, six have a wide range both in Asia and Africa, three extend from Arabia through Persia to N.W. India, one is a widely distributed Asiatic form, one occurs in Asia Minor, and eight are common to Arabia and Africa, several of these ranging through East Africa to the Cape.

Nymphalidæ.

1. Limnas chrysippus.

Papilio chrysippus, Linnæus, Mus. Lud. Ulr. p. 263 (1764).

Both sexes were obtained.

2. Ypthima asterope.

Hipparchia asterope, Klug, Symb. Phys. pl. xxix. figs. 11–14 (1832).

A female and four males.

This butterfly would seem to be common throughout Arabia wherever insect-life is possible; it also occurs in N.E. Africa.

3. Hypolimnas misippus.

Papilio misippus, Linnæus, Mus. Lud. Ulr. p. 264 (1764).

A series of worn specimens in both sexes.

The extensive range of this butterfly is well known.

4. Junonia swinhoei.

Junonia swinhoei, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvi. p. 309 (1885).

Two worn females.

These examples are referable rather to the Indian species than to *J. here* (found at Aden).

Lycænidæ.

5. Catochrysops contracta.

Lampides contracta, Butler, P. Z. S. 1880, p. 406, pl. xxxix. fig. 3.

Three males of this Indian species which I originally described

from examples obtained at Candahar; it appears to have a wide range.

6. Tarucus theophrastus.

Hesperia theophrastus, Fabricius, Ent. Syst. 3. i. p. 281 (1793).

A fair series, but in poor condition.

This again is a wide-ranging species.

7. Lycænesthes amarah.

Polyommatus amarah, Lefebvre, Voy. Abyss. vi. p. 384, pl. xi. figs. 5, 6 (1847).

A rather small and worn pair.

8. Zizera gaika.

Lycæna gaika, Trimen, Trans. Ent. Soc. ser. 3, vol. i. p. 403 (1862).

Seven rather worn examples.

This is a common and widely distributed African and Arabian insect.

9. Plebeius trochilus.

Lycæna trochilus, Freyer, Neuere Beitr. v. pl. 440. fig. 1 (1844).

Three examples.

10. Virachola antalus.

Dipsas antalus, Hopffer, Monatsb. k. Akad. Wiss. Berlin, 1855, p. 641.

Sithon antalus, Hopffer in Peters' Reise n. Mossamb., Ins. p. 400, pl. xxv. figs. 7–9 (1862).

♀, slightly broken; very deep in colour.

This species is common over a considerable part of Africa, Madagascar, and the Island of Johanna; it varies somewhat on both surfaces as regards the depth of colour above and definition of the markings below.

Papilionidæ.

11. Teracolus calais, var. dynamene.

Pontia dynamene, Klug, Symb. Phys. pl. vi. figs. 15, 16 (1829).

One worn male.

12. Teracolus phisadia.

Pieris phisadia, Godart, Enc. Méth. ix. p. 132 (1819).

Three males, two of them much shattered.

An interesting fact respecting this species is that, whereas all the Arabian males show a wet phase of under-surface and the Arabian females a dry phase, the same species from Northern Africa sometimes shows a dry phase in the male; I have not seen enough African examples to enable me to say whether a wet phase of female ever occurs.

13. Teracolus liagore.

Pontia liagore, Klug, Symb. Phys. pl. vi. figs. 5–8 (1829).

Three males and a female.

These examples, and especially the female, were of considerable interest to me, for they prove conclusively that in my recent revision of the genus *Teracolus* I was incorrect in referring *T. liagore* (as a seasonal phase) to *T. evarne*. I never felt quite satisfied that I was correct in so doing, as the form and pure white colouring of *T. liagore* looked out of place among the more rounded yellow-washed wings of the various seasonal phases of *T. evarne*. Now that the female and three somewhat varying males have come to hand, I am quite satisfied that *T. liagore* is merely a dry phase of the N. African *T. daira* and grades completely into *T. nouna*. It is odd that a related yet distinct species should occur at Aden.

14. Teracolus eupompe, var. dedecora.

Anthopsyche dedecora, Felder, Reise der Nov., Lep. ii. p. 184 (1865).

A slightly worn female.

Here again we have a North African type.

15. Catopsilia florella, var. pyrene.

Colias pyrene, Swainson, Zool. Ill. 1st ser. pl. 51 (1820–1).

Several worn examples.

It is probable that, as at Aden, the various forms of this species occur together, but only the variety *pyrene* appears in the present consignment.

16. Synchloe iranica.

Pieris iranica, Bienert, Lep. Ergebn. p. 27 (1870).

A fair series.

It is interesting to receive this Persian insect from Muscat, and to know that the nearly related *S. glauconome* is common to Aden and East Africa.

17. Belenois mesentina.

Papilio mesentina, Cramer, Pap. Exot. iii. pl. cclxx. A, B (1782).

Four examples (wet phase).

18. Papilio demoleus.

Papilio demoleus, Linneus, Mus. Lud. Ulr. p. 214 (1764).

Several examples of this Indian species [1].

19. Parnara mathias.

Hesperia mathias, Fabricius, Ent. Syst. Suppl. p. 433 (1798).

Two worn males of this Indo-African species.

[1] The Hon. W. Rothschild has shown that the true *P. demoleus* is not, as formerly supposed, the African species.

BRITISH MUSEUM 130099

11. Notes on the Antipatharian Corals of Madeira, with Descriptions of a new Species and a new Variety, and Remarks on a Specimen from the West Indies in the British Museum. By James Yate Johnson, C.M.Z.S.

[Received May 22, 1899.]

The marine objects popularly called Black Corals are zoophytes which constitute the group of Antipatharia in systematic zoology. Some of them are much branched and resemble bushes that occasionally reach the height of four or five feet. Others extend their branches almost in one plane in a fan-like manner; others, again, are simple unbranched stems, slender and wire-like, that are sometimes found with a length of seven or eight feet. All are attached, when living, to submarine rocks or stones by a thin spreading base. All have a hard horny axis of a black or brown colour, and that axis is seen, on examining a section, to consist of concentric layers. Further examination will show that it has a fibrous structure. Stem and branches are frequently armed with minute spines arranged in longitudinal or spiral series, but sometimes the stem and main branches are smooth and polished. The hard axis is secreted by the soft polypiferous cœnenchyma which clothes it. The polyps in the Madeiran forms have six (in one species twenty-four) simple tentacles. Spicula are not anywhere present, and thus the Antipatharia are easily distinguished from the Alcyonaria.

Eight species of Black Coral belonging to six genera have been found at Madeira, more than one-thirteenth of the total number of known species. In the late George Brook's excellent Report on the Antipatharia of the 'Challenger' Expedition (1889) ninety-eight species were dealt with, but these included not only the forms collected by the naturalists of that expedition but all those previously described. The Report is therefore a Monograph of the group. Until the publication of that work much difficulty was experienced in coming to a conclusion with regard to the discrimination of species and the identification of specimens, owing to imperfect description and confusion of nomenclature; and even now, notwithstanding that author's efforts, much remains to be done, especially in regard to our knowledge of the polyps, before satisfactory definitions are possible and the classification placed on a trustworthy basis.

All the species of Madeira come from depths below 40 fathoms They are brought to the surface by becoming entangled now and then in the lines of the fishermen.

Of the eight species of Black Coral here treated of, five have not hitherto been found elsewhere, and one of these is now described for the first time (*Leiopathes expansa*). Another of the five species, having been confused with a West Indian species, is here distinguished by a fuller description, whilst a new name has

been necessarily imposed on the tropical form. Furthermore, another of Gray's species (*Antipathes setacea*) has been removed from the position it occupied of a queried synonym and is re-established as distinct by a more detailed description. Two of the eight species here dealt with (*Savaglia lamarcki* and *Leiopathes glaberrima*) are known in the Mediterranean, which great sea possesses apparently a smaller number of species than the sea immediately surrounding the diminutive island of Madeira, for it seems that not more than six forms can with certainty be attributed to the former. These are (in addition to the two already mentioned as common to the two seas) *Antipathes dichotoma* Pall., *A. mediterranea* Brook, *Antipathella subpinnata* (E. & S.), and *Parantipathes larix* (Esper). The existence in the Mediterranean of any elongate unbranched form like *Cirripathes* requires confirmation.

Gen. Savaglia Nardo, 1843.

Corallum horny, without spines; polyps with 24 tentacles in alternate rows of twelve each.

Savaglia lamarcki (Haime).

Savaglia lamarcki, Brook, Antipatharia of the 'Challenger,' p. 79.
Gerardia lamarcki, Lacaze-Duthiers, 1864.
Leiopathes lamarcki, Haime, 1849.

Moderately branched, furcately, in one plane. Axis black or brown; trunk and branches very sinuous, not cylindrical, but compressed laterally so that the anterior and posterior faces are narrower than the intervening sides and the angles are rounded off. There is no groove on any of the faces or sides. The surface of the stem and main branches is seen under the lens to be minutely wrinkled and finely punctured, the punctures being numerous and irregularly scattered. The branches are elongate and tapering, very seldom fusing together.

Only two specimens of this species have come under my observation. Neither has a base. The smaller example has a height of 70 centim. (27½ in.) and a spread of 45. It has been entirely stripped of its polyps. The other is 85 centim. (32⅓ in.) high, and the longer axis of the lower part of the stem measures 15 millim. It has lost most of its branches; there are remains of the cœnosarc and polyps on the highest ones; their oval mouths, with thickened lips marked by radiating grooves, are large and conspicuous, the longer axis measuring 4 millim.

There is some doubt as to the true zoological position of this organism. The horny branched axis has all the appearance of being antipatharian, but the polyps with their 24 tentacles are closely allied to the Zoanthidæ, especially to the genus *Parazoanthus* Haddon & Shackleton. Carlgren therefore has advocated the removal of *Gerardia lamarcki* from the Antipatharia to the Zoanthidæ

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('Ueber die Gattung *Gerardia*,' 1865), and Pourtalès in 1871 took the same view.

In the cœnosarc of Mediterranean examples of this species Lacaze-Duthiers found a peculiar cirripede which he named *Laura gerardiæ*. This has not been observed in Madeiran specimens.

Hab. Madeira; Mediterranean.

Gen. STICHOPATHES Brook.

Axis forming a long, slender, flexible rod without branches. Polyps arranged in a longitudinal series on one side of the stem, not distributed on all sides as in *Cirripathes*; tentacles six.

STICHOPATHES GRACILIS (Gray).

Antipathes (*Cirripathes*) *gracilis*, Gray, P. Z. S. 1857, p. 291.

Stichopathes gracilis, Brook, Antipatharia of the 'Challenger,' p. 90.

Jet-black; the stem throughout armed with short conical spines at right angles to it, arranged irregularly in spirals (fig. III. 1, p. 823). On the lower part of the stem there are about nine series. The base spreads thinly over the object to which it adheres, and is from 10 to 15 millim. in diameter. The lower part of the stem is usually from 3 to 4 millim. in diameter.

This species is not of very rare occurrence. The individuals are commonly attached to a well-rounded stone or to masses of calcareous sand cemented by shells, worm-cases, &c. One small specimen had seated itself on the spineless test of a dead sea-urchin (*Arbacia*). Two or more may sometimes be seen adhering to the same stone, and, indeed, I had once observed as many as twelve individuals on the same block. But great was my astonishment when a stony mass, 10 in. by 5, was shown to me upon which were seated more than 120 specimens, in two groups, some 20 being separated from the rest, which formed a grove so thickly planted that it was difficult to count them correctly. Unfortunately the majority were broken, leaving stems only a few inches long; the length of the perfect ones was about three feet.

Two and even three distinct stems may spring from the same basal expansion. It may have been that the bases were at first separate and afterwards coalesced as they extended, but there was no evidence to show that this had been so. The largest specimen that has been met with at Madeira had a length of 9 ft. 3 in. (2820 millim.). This has been placed in the Seminario Museum, Funchal. In contrast with specimens of this size, young ones 6 millim. long have been found, and two of these have been mounted in balsam on a slip of glass.

Brook says that the stem is sinuous but not spiral. Two specimens, however, are in my possession which in their upper part form a few very loose irregular spirals. They are on the same mass of indurated sand, shells, worm-cases, &c.

Normally the individuals of this species are destitute of branches

but I have a specimen which has put forth a very slender spineless branch 150 millim. (nearly 6 in.) long. This abnormality was perhaps due to the fact that the upper end of the stem, four or five inches above the ramus, had been broken off by some accident, and the branch may have been the result of an effort on the part of the colony of polyps to continue their growth.

With regard to the spines, those of all the specimens I have seen are simple and conical, but Brook says that the majority of those on the older portions on the stems of specimens in the British Museum formed double spines.

Hab. Madeira.

STICHOPATHES SETACEA Gray.

Antipathes (*Cirripathes*) *setacea*, Gray, Ann. & Mag. N. H. ser. 3, vol. vi. p. 31 (1860).

? *Antipathes simplex*, Alcide d'Orbigny in Webb & Berthelot's Hist. Nat. des Iles Canaries, Zoologie : Polypiers, p. 151.

Dr. Gray's description of his *A. setacea* runs thus :—"Coral simple, elongate, setaceous, straight, erect, closely covered with short conical spinules. Length 18 in. Hab. Madeira." He said further that it was straight, without the slighest tendency to assume a spiral form. Mr. Brook (Antipatharia of the 'Challenger,' p. 90) stated that he had been unable to find Gray's type of *A. setacea*, and added—"As I have no means of ascertaining what form Gray did regard as *A. setacea*, and as his description of the type contains no characacter not applicable to this species (i. e. *Stichopathes gracilis* Gray), I have given *A. setacea* as a probable synonym."

In going over my collection of Antipatharia for the purpose of preparing this paper, I have found a small specimen, which, fragmentary as it is, proves beyond a doubt that Gray's *A. setacea* is a good species, quite distinct from *Stichopathes gracilis*.

The specimen referred to is a portion of a stem broken at both ends; what remains has a length of only 14·5 millim. ($5\frac{8}{9}$ in.), with a diameter at the thicker end of scarcely so much as ·75 millim. It tapers very gradually, and there is a wide central channel. It is bent into a semicircular form, and it has a brown colour. The spines are numerous and arranged in longitudinal rows, of which about six may be seen in one aspect. They are upright, high in comparison with the diameter of the stems, and more or less compressed. A few are simple and pointed, but most of them are bifid or notched irregularly at the tips (fig. III. 2, p. 823). Sometimes there are narrow longitudinal ridges bearing as many as five spikes. Measuring from tip to tip of the spines in the same row, the interval between any two is about equal to three or four times the height of each. Polyps are altogether absent.

The specific name and Gray's epithet "setaceous" are suitable enough to this very slender form, but are quite inapplicable to *Stichopathes gracilis*. Alcide d'Orbigny (*loc. cit.*), a reference not given by Brook, described a small *Antipathes* from the Canaries,

which may possibly have been of this species or a young *St. gracilis*, in these terms: "*Antipathes* simplicissima, elongata, filiformis, longitudinaliter sexcostata, costis echinatis. Long. 35 mm."
Hab. Madeira.

Gen. Leiopathes (Gray), Brook.

Corallum much branched; stem and thicker branches polishe spineless, ultimate branches bearing very small and distant spines. Polyps on all sides of the branches, with 12 mesenteries in the oral cone, 6 below; tentacles six.

Leiopathes glaberrima (Esper), M.-Edw.

Corallum branching on all sides, forming a bush; stem and main branches thick; branchlets springing nearly at right angles from opposite sides of the branch subalternately; spines on the ultimate branchlets very short, conical compressed, at right angles to the branch.

This species has been found in the Mediterranean, and it is believed to be the only Old World antipatharian that occurs in the West Indies. A fine specimen, 150 centim. (4 ft. 11 in.) and 80 centim. (31 in.) through, was obtained off Seixal, a village on the N.W. coast of Madeira, and has been placed in the Seminario Museum, Funchal. It is destitute of its base; the stem below the first branch is only 12 millim. thick. There are two main branches which run to a great length and in their lower parts are almost as thick as the stem. These and the secondary branches are strongly and irregularly sinuous, and with the ultimate branchlets form a round bush. The branchlets are very fine and hair-like, and are set with short, broad, conical upright spines at irregular distances apart, not in rows or whorls. The stem and main branches are black, smooth, and shining. Nowhere is there any fusion of the branches. The branches were thickly covered with polyps of a warm brown colour. The tentacles were subulate in form and much longer than the body.

Several other specimens of a smaller size have occurred from time to time. It was remarkable that not a single organism of any kind had established itself parasitically on any part of the large specimen, a great contrast with *Aphanipathes wollastoni* when it is brought up to the surface.

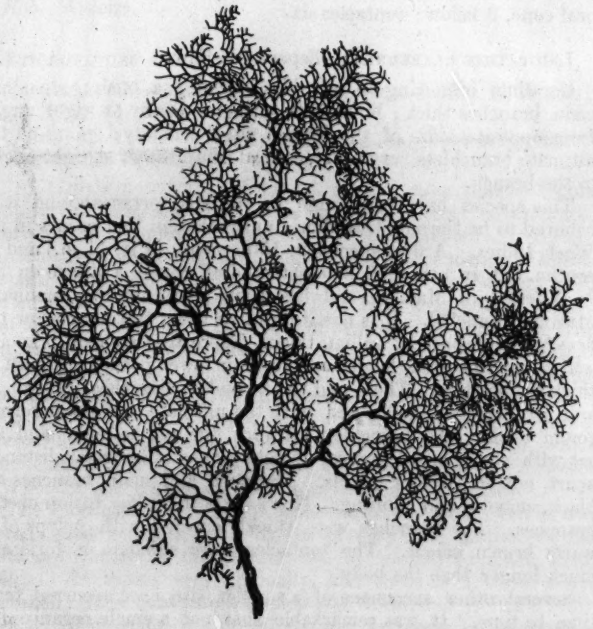
Hab. Madeira, Mediterranean, W. Indies.

Leiopathes expansa, sp. n. (Fig. I., p. 818.)

Much branched in one plane or in parallel planes to the sixth degree of subdivision. Stem and branches elliptical in section, jet-black, polished, bent into irregular zigzags, the branches being thrown off alternately on opposite sides. All the branches arise almost at right angles from the parent branches at a distance from each other. The ultimate branchlets are very slender, hair-

like, tapering, and sharpened off to a point at the extremity. Minute upright conico-subdeltoid spines are irregularly scattered on the ultimate branchlets, the other parts of the corallum being spineless (fig. III. 3, p. 823). Polyps pale red, with six tentacles. The remains of the cœnenchyma and polyps are seen on the specimen as a brown pellicle coating the finer branches, and extending as a thin web or film from branch to branch.

Fig. I.



Leiopathes expansa, sp. n. About ⅔ nat. size. From a photograph.

The only specimen of this new species that I have met with was obtained from a fisherman twenty years ago. It is without a base, and has a height of 405 millim. (16 in.), with a spread of 380 millim. (15 in.), but its spread when perfect was probably not less than 445 millim. (17½ in.). The thickest part of the stem is only 5 millim. in diameter.

No fusion of branches is anywhere visible. The elegant flabellate form and delicate habit seem to distinguish this sufficiently from known species of *Leiopathes*.

Hab. Madeira.

Gen. Antipathes.

Shrub-like, branches not fusing; spines numerous, strong. Polyps large; tentacles six, radiating, one pair in a line with the oral slit inserted low down, the others at the margin of the peristome.

Antipathes furcata Gray.

Antipathes furcata, Gray, P. Z. S. 1857, p. 291.

Antipathes? *furcata*, Brook, Antipatharia of the 'Challenger,' p. 104, pl. xi. fig. 2.

No specimen of this species has been met with by me, but Gray's type, obtained by N. Mason at Madeira in 1857, is in the British Museum. Brook believed it to be only a branch of the entire corallum. The habit is different from that of the other bushy Black Corals of Madeira. In order to enable collectors to identify any specimens that may occur, an abbreviation of Brook's description is here given.

The specimen is 16 centim. (6¼ in.) high. The axis is very slender and bears a number of elongate bristle-like branches, which are directed subvertically and reach to about the same height. The branches give off secondary branches at irregular intervals, and the longer ones bear a third series of branchlets, usually on one side only. Nearly all the branchlets are directed upwards and most of them reach the apex of the corallum, and thus it has a corymb-like aspect. The spines are short, triangular, and compressed, with the apex at right angles to the axis. Six longitudinal rows can be seen from one aspect, and the spines in a row are three or four times their own height distant from one another. Polyps?

Hab. Madeira (*Mason*): British Museum.

Gen. Antipathella Brook.

Branching in one plane, branches not fusing together; spines short, upright; polyps small, with six tentacles, in two series of three each.

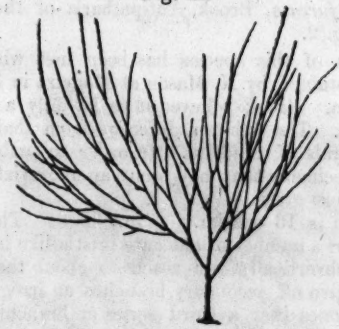
Antipathella gracilis (Gray). (Fig. II., p. 820.)

Antipathes gracilis, Gray, Ann. & Mag. Nat. Hist. ser. 3, vol. vi. 1860, p. 311; not *Antipathella gracilis*, Brook, Antipatharia of 'Challenger,' p. 113.

In 1860 Dr. Gray (*loc. cit.*) gave a short description of a small and delicate antipatharian from Madeira and assigned to it the specific name *gracilis*. In 1888 Mr. Brook, when preparing his monograph of the group, was not able to find in the British Museum any specimen from Madeira bearing that name; but he found there a Black Coral from the West Indies to which was attached a label with the name in Gray's handwriting of *Antipathes gracilis*. Under these circumstances, Brook in his Report described the West-Indian specimen under the name of *Antipathella gracilis* (Gray). This was a mistake which he would not have committed

if he had had a specimen of the true *A. gracilis* from Madeira before him. Indeed he himself felt uncertain whether the course he took was right, for he says he was "at a loss to understand Gray's description," and added that it seemed "doubtful whether this specimen (that from the West Indies) could be considered to agree with Gray's definition of the species."

Fig. II.



Antipathella gracilis, about $\frac{1}{2}$ nat. size.

An examination of specimens obtained at Madeira proves beyond dispute that Gray's short description of *A. gracilis* applies to them; whilst a study of Brook's description of the West-Indian specimen leads to the conclusion that the latter cannot belong to the same species. I shall therefore proceed to give a fuller account of the Madeiran form under Gray's name of *gracilis*; and then, rather than leave the West-Indian specimen without a name, I shall repeat Brook's description of it and assign to it the name of *brooki*. In this way I hope that the confusion surrounding the two forms will be cleared away and the nomenclature settled once for all.

Antipathella gracilis (Gray).—Corallum black, very slender, arising from a small round flat base, sparingly and laxly branched in one plane; branches distant, elongate, straight, never confluent; ultimate branchlets setiform, tapering to a point, from 20 to 50 millim. long. The corallum is everywhere set with minute triangular upright spines (Fig. III. 4, p. 823), those on the stem forming about seven longitudinal rows. Polyps disposed in a series on one side of the branches, separated by short intervals (fig. III. 5, p. 823).

The corallum seldom exceeds 150 millim. (6 in.) in height and has a spread of rather more. The thin base has usually a diameter of about 6 millim. and the lower part of the stem is not more than about 1·5 millim. in diameter. The branches make an angle of 30° or 40° with the stem. This species seems to live gregariously, as the dredge will sometimes bring up a quantity of it. One specimen was found attached to an old individual of

Aphanipathes wollastoni. Others have been discovered seated on the telegraph-cable when hauled up for repairs from a considerable depth. The figure shows one of these, a small but characteristic specimen, only 106 millim. ($4\frac{1}{8}$ in.) high, with a spread of 110 millim. ($4\frac{3}{8}$ in.).

Hab. Madeira.

[ANTIPATHELLA BROOKI, nom. nov.

Antipathella? gracilis, Brook, Antipatharia of the 'Challenger,' p. 113, non Gray.

The specimen in the British Museum is 56 centim. ($22\frac{3}{8}$ in.) high, and is related to other flabellate forms included in the genus *Antipathella*. The base consists of several stems fused together, which give rise to a series of branches not all in the same plane, with frequent fusions. Upper portion more spreading, but the larger branches are still strong and are often fused together. In some portions nearly all the branches come off from one side and are placed at irregular intervals. Secondary branches mostly very slender. Medium branches bear branchlets irregularly varying in length from 15 to 100 millim., usually longer on one side than the other. Smaller branchlets simple and filiform; the larger ones are again branched irregularly, the ultimate pinnules being very slender and rarely attaining a length of 12 millim. without becoming branched. Spines (Brook, Antip. Chall. pl. xi. f. 8) short and conical with a slender apex, arranged in dextrorse spirals. Five rows are visible from one aspect of a pinnule, the members of a row being from two to three lengths apart. (Brook, *loc. cit.*)

Hab. West Indies (*Scrivener*).]

Gen. APHANIPATHES Brook.

Corallum paniculate or flabellate; spines long and slender; polyps obscure, with short tentacles.

APHANIPATHES WOLLASTONI Brook.

Aphanipathes wollastoni, Brook, Antipatharia of the 'Challenger,' p. 126.

Antipathes subpinnata Gray (non Ellis & Sol.), P. Z. S. 1857, p. 293.

Colour dark brown. Bushy, shrub-like, branched to the fourth or fifth degree of subdivision. The secondary branches elongate, often reaching to the top of the bush. Ultimate branches very numerous, very slender and varying considerably in length. They and the penultimate branches are thickly set with spines which are arranged in six or seven longitudinal rows as well as in irregular spirals. The simple, tapering, acute spines rise from a broad thick base and are directed obliquely forwards.

The polyps are seated on the upper side of the branchlets in a single row at a distance from each other. Six short, thick, conical

tentacles, pale brown in colour, surround a puffed-out mouth, the whole covered with vibratile cilia. The polyps are very full of stinging-threads (fig. III. 6, p. 823).

"This is the species which Gray referred to *Antipathes subpinnata* E. & S. It differs essentially from that species in the arrangement of the pinnules and in the form of the spines."—Brook, *loc. cit.* p. 127.

One of my specimens 35 centim. high has a thin base 35 millim. by 25 millim. From this base rise not only the large corallum, but several small ones from 25 to 50 millim. high.

This is the commonest of all the species found at Madeira. It is usually attached to loose stones, but in one case within my knowledge a specimen two feet high was growing upon a quaintly shaped metal tankard, the whole exterior of which was completely hidden from view by a crust of bryozoa, worm-cases, &c.

Individuals of this species are often made common lodging-houses for the use of a heterogeneous throng of guests. More than 25 different forms, including mollusks (*Ostrea cochlear* and *Avicula tarentina*), bryozoa, worm-cases, hydrozoa, *Polytrema*, and sponges, have been seen crowding on the lower branches of a single specimen; thus offering a great contrast to specimens of *Leiopathes glaberrima*, which are always free from parasitical attendants, a difference doubtless due to the abundance of spines on the one form and their absence from the other.

What is still more curious is that a small stalked cirripede, the *Oxynaspis celata* of Darwin, is found attached in numbers to the branches of this *Aphanipathes* and nowhere else. The antipatharian covers the valves of the cirripede with a thin horny coat beset with minute spines.

In Alcide d'Orbigny's list of the zoophytes of the Canary Islands, in Webb and Berthelot's work, appears the name of *Antipathes subpinnata* Ellis & Sol. This may have been a specimen of *Aph. wollastoni*.

Hab. Madeira; Selvagens or Salvages; Canary Islands?

Var. PILOSA, nov.

Bushy, branching irregularly; in general characters resembling the typical species, but a distinct aspect is given to the present form (1) by the ultimate branchlets being stouter with reference to the branch from which they spring; (2) the angle they make with the branch is more obtuse; (3) they spread in all directions from the branch, whereas in the typical species the ultimate branchlets have a tendency to spread in one plane. The spines have much the same form as in the typical species: that is, they are long, slender, pointed and directed forwards, and are arranged in longitudinal rows; but in the present form they differ by being longer in regard to the diameter of the branch on which they are placed, and by being less closely set (fig. III. A). On the lower part of the stem the spines are frequently forked at the top. This variety is remarkable in this, that the stem bears numerous

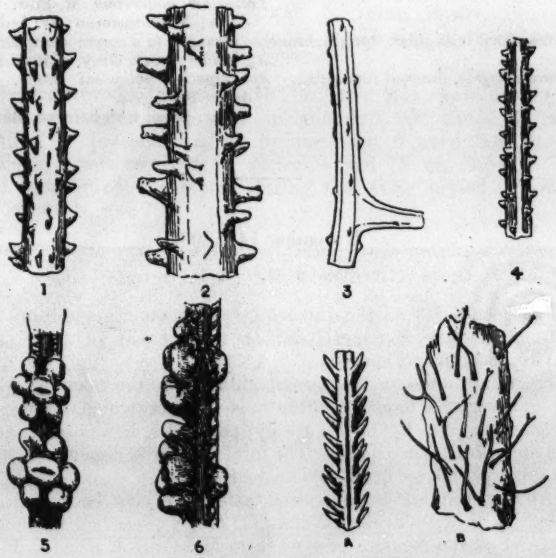
scattered microscopic hairs, which are seated on thick bases and taper to a fine point. They sometimes fork near the tip (fig. III. B).

A single specimen has been in my possession for many years. It is without a base, and may possibly be only a branch of the entire corallum. It has a length of about 205 millim. (8 inches) and measures 180 millim. (7 in.) through.

Should other specimens occur, a careful examination of them might lead to the conclusion that this form is entitled to rank as a species.

Hab. Madeira.

Fig. III.



Arrangement of spines, all ×15.

1. *Stichopathes gracilis* (p. 815) near apex of stem. 2. *Stichopathes setacea* (p. 816). 3. *Leiopathes expansa* (p. 817), ultimate branchlet. 4. *Antipathella gracilis* (p. 819). 5. Same, with two polyps. 6. *Aphanipathes wollastoni* (p. 821), with polyps. A. *Aph. wollastoni* var. *pilosa* (p. 822), branchlet. B. Same, part of stem.

Key to the eight Madeiran Species of Antipatharia.

A. Simple stems.

Stem as thick as a goose-quill; spines simple ...	*Stichopathes gracilis* (Gray). Madeira.
Stem very slender; spines forked or jagged	*Stichopathes setacea* (Gray). Madeira.

B. Branched.

a. Branching in one plane.

Short, very slender, sparingly branched; covered with spines.
Antipathella gracilis (Gray). Madeira.
Spines on the ultimate branchlets only; stem smooth.
Leiopathes expansa J. Y. J. Madeira.
No spines; stem and branches wrinkled and punctured.
Savaglia lamarcki (Haime). Madeira, Mediterranean.

b. Branching on all sides, bushy.

Spines only on the ultimate branchlets.
Leiopathes glaberrima M.-Edw. Madeira; Mediterranean; W. Indies.
Spines short, triangular, upright, branches arranged in a corymbose manner.
Antipathes furcata Gray. Madeira.
Spines elongate, directed forwards... *Aphanipathes wollastoni* Brook. Madeira; Selvagens.
Var. *pilosa* with hairs on the stem.

November 14, 1899.

Dr. A. Günther, F.R.S., V.P., in the Chair.

The Secretary read the following reports on the additions made to the Society's Menagerie during the months of June, July, August, September, and October, 1899:—

The total number of registered additions to the Society's Menagerie during the month of June was 164, of which 79 were by presentation, 18 by birth, 40 by purchase, 1 was received in exchange and 26 on deposit. The total number of departures during the same period, by death and removals, was 78.

Among the additions special attention may be called to a male Sitatunga, or Speke's Antelope (*Tragelaphus spekii*), from the district of Lake Ngami, received from Mr. Cecil J. Rhodes, F.Z.S., in exchange for a female hybrid between *Tragelaphus gratus* ♂ and *T. spekii* ♀ (born in the Menagerie on Feb. 12, 1896), which was despatched to Mr. Rhodes on April 25th last.

The total number of registered additions to the Society's Menagerie during the month of July was 204, of which 77 were by presentation, 19 by birth, 36 by purchase, 1 was received in exchange and 71 on deposit. The total number of departures during the same period, by death and removals, was 108.

Amongst the additions special attention may be called to the fine Ground-Hornbill presented by Dr. Hirst on July 20th, which appears to be a young example of *Bucorax abyssinicus*, and concerning which the following information has been received from Dr. Hirst:—

The Elms, Goldthorn Hill,
Wolverhampton, July 17, 1899.

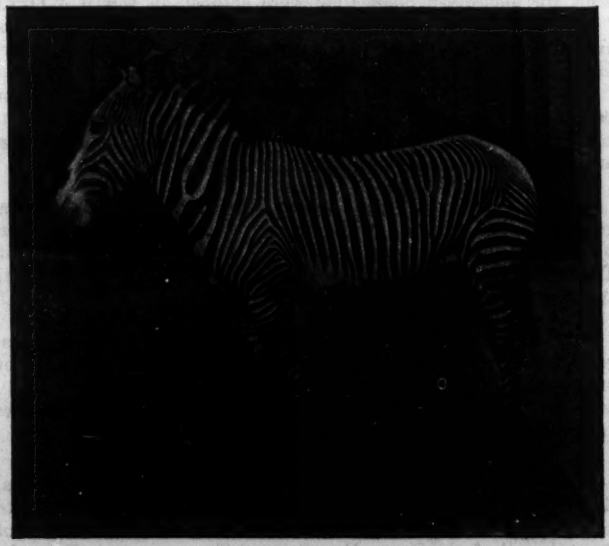
SIR,

I have recently returned from West Africa and brought with me a large bird, which I think you may like to have in the Zoological Gardens. The bird, which was caught on the R. Volta, Gold Coast, W. Africa, stands about 2 feet in height, has an enormous beak, and lives on the banks of the river, wading into the water and catching fish, on which it lives. I have had this bird in my possession some six or eight months, and it is now quite tame.

I am, Sir,
Yours truly,
GEO. HIRST,
The Colonial Medical Service.

The Secretary,
Zoological Society, 3 Hanover Square, W.

The registered additions to the Society's Menagerie during the month of August were 102 in number. Of these 37 were acquired by presentation, 40 by purchase, 6 were born in the Gardens, 1 was received by exchange and 18 on deposit. The total number of departures during the same period, by death and removals, was 100.



Grévy's Zebra (female).

Amongst these may be specially noticed a pair of Grévy's Zebras (*Equus grevii*), deposited by H.M. The Queen on August 14th.

We have now the pleasure of being able to exhibit in the Gardens a pair of the beautiful Zebra of Southern Abyssinia and Somaliland (*Equus grevii*), to the existence of which I have on several former occasions (see P. Z. S. 1882, p. 721; 1890, pp. 412, 461; 1893, p. 473; 1898, p. 588; 1899, p. 713) called attention. The present animals have been sent by the Emperor Menelek as a present to H.M. the Queen, and have been deposited in the Society's care to be recovered from the effects of their long and arduous journey. I need hardly descant on the differences between the present animal and the three previously known species of Zebra, both in size and in character of markings, as they are obvious at first sight. These animals were captured somewhere in the south of Shoa, and are said to be the only survivors of a considerable number which reached Addis Abbeba. Here they were delivered to Capt. J. L. Harrington, the British Political Agent at the Court of the Emperor Menelek, as a present to H.M. the Queen, and were brought down under his care to Zeila on the coast of Somaliland, a long march of six weeks. At Zeila Capt. Harrington handed them over to our Assistant Superintendent, Mr. Arthur Thomson, who had been sent there by the Council, at the request of the Foreign Office, on purpose to take charge of them. Having been conveyed across to Aden, where they were kept for about ten days, they were shipped in the P. & O. s.s. 'Oceana,' and arrived safely at the Royal Albert Dock on August 14th last, and were thence brought to the Society's Gardens.

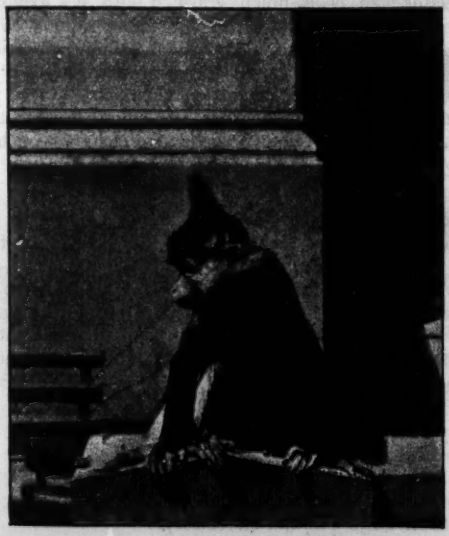
The female, of which I exhibit a photograph (see p. 825), may now be announced to be in perfect condition; but the male, I regret to say, still shows wounds on the hocks, which, in spite of every care and attention, we have been unable to cure.

The total number of registered additions to the Society's Menagerie during the month of September was 126, of which 84 were by presentation, 9 by purchase, and 33 were received on deposit. The total number of departures during the same period, by death and removals, was 90.

The total number of registered additions to the Society's Menagerie during the month of October was 170, of which 31 were by presentation, 68 by purchase, 61 were received on deposit, and 10 were born in the Menagerie. The total number of departures during the same period, by death and removals, was 169.

Mr. Sclater stated that in July last he had visited the Zoological Gardens of Rotterdam, Amsterdam, and Antwerp, the private collection of Mr. F. E. Blaauw, C.M.Z.S., and the Museums of Brussels and of the Congo Free State at Tervueren near Brussels. Mr. Sclater spoke of several animals of much interest which he had thus seen. Amongst these were a pair of Slow Lemurs (*Nycticebus tardigradus*) at Rotterdam with a young one, which

was carried by the mother across her breast after the manner of other Lemurs; also a young Pelican (*Pelecanus onocrotalus*), hatched in the same Gardens and then still in nestling plumage. The Amsterdam Gardens were fortunate in again possessing a living *Anser ruficollis*, which had been captured about the 10th February, 1899, at Foxhol, near Hoogeram, in the province of Groningen; also several specimens of the now rare Talapoin Monkey (*Cercopithecus talapoin*), and two examples of the beautiful Red Oriole of Formosa (*Analcipus ardens*), besides a family group of the Pleasant Antelope (*Tragelaphus gratus*), consisting of an adult pair, two young males, and a newly-born calf. At Antwerp there was, likewise, a small herd of *Tragelaphus gratus*, consisting of an adult pair and two young females; also a fine adult male of the Roan Antelope from Senegal (*Hippotragus equinus gambianus*) (see 'Book of Antelopes,' iv. p. 15, pl. lxxviii.), and three examples of the true Dama Gazelle (*Gazella dama*), from Senegal. In the Antwerp Gardens Mr. Sclater had likewise examined a living female monkey which appeared to belong to a new species of the genus *Cercocebus*, remarkable for its prominent crest on the middle of the head and the long hairs on the cheeks. This specimen had been received by the Antwerp Gardens as a present from M. F.



Cercocebus congicus.

Fuchs, the Governor of the Congo Free State, and was believed to have been obtained, in March 1899, in the district of Stanley Falls on the Upper Congo.

With the approbation of M. L'hoëst, Mr. Sclater proposed to

designate this species *Cercocebus congicus* with the following characters :—

CERCOCEBUS CONGICUS, sp. nov. (Woodcut, p. 827.)

Niger, subtùs nudiusculus, cristâ extante longâ nigrâ : genarum pilis productis albis : manibus et pedibus cum facie carneis : mento et pectore albis, ventre nigricante, tibiis albis : brachiis nigris, caudâ albicante. Long. corp. 2, *caudæ* 3, *totâ* 5 *ped. Angl.*

Hab. Terra Congica.

In the new Museum of the Congo Free State at Tervueren, near Brussels, Mr. Sclater had been able to examine the series of specimens of Antelopes of the Congo Territory, which contained examples of the following species :—

1. *Cephalophus maxwelli* (Lower Congo).
2. *Cephalophus grimmi* (Lower Congo).
3. *Cobus penricei* (Matadi).
4. *Cervicapra arundinum* (Lower Congo).
5. *Hippotragus equinus* (Lower Congo).
6. *Tragelaphus gratus* (Lower Congo).
7. *Tragelaphus scriptus* (Cataracts of Lower Congo).

Mr. Sclater had been much gratified with the examination of these specimens, as he had never previously seen a collection of Antelopes from Congoland. He called special attention to the fact of the Waterbuck being *Cobus penricii* (see 'Book of Antelopes,' ii. p. 113, pl. xxxv.), as this species was previously known only from the southern part of Angola, also to the fact of the Roan Antelope apparently belonging to the southern form *Hippotragus equinus typicus*.

Mr. Sclater gave a short account of his journey to the Cape, from which he had just returned, after an absence of ten weeks. The state of the country caused by the impending war had prevented him from obtaining so many animals as he had hoped to do. But the keeper whom he had taken with him had returned to this country on the 15th inst. with the following animals, which had been mostly obtained from various friends and correspondents :—

1 White-tailed Gnu (*Connochætes gnu*), ♂.
*1 Roi Rhebok (*Cervicapra fulvo-rufula*), ♂.
2 Dusty Ichneumons (*Herpestes pulverulentus*).
1 Cape Crowned Crane (*Balearica regulorum*).
†2 Schalow's Touracous (*Turacus schalowi*).
4 Cape Turtle Doves (*Turtur capicola*).
1 Vulturine Eagle (*Aquila verreauxi*).
1 Tawny Eagle (*Aquila nævioides*).

* New to the Society's Collection.

† This beautiful pair of Touracous were captured at Npata, near Mossamedes, Angola, by one of Mr. W. L. Sclater's correspondents. [They have been well figured by Mr. Frohawk in 'The Field' (vol. xciv. p. 891, Dec. 2nd, 1899).]

Mr. Sclater also stated that he had given an address at a Meeting of the South African Philosophical Society at Capetown on September 17th, "On the desirability of establishing a Zoological Garden in Capetown," and that the Society had appointed a Committee to consider the subject. Mr. Sclater was in hopes that this movement might ultimately lead to good results.

Mr. Lydekker exhibited the mounted head of a remarkably fine Swamp-Deer (*Cervus duvauceli*), shot by Major C. B. Wood, of Toms Hill, Aldbury, Tring, on the 5th of January, 1899, in the

Head of Swamp-Deer (*Cervus duvauceli*) from Central Provinces, India.

Central Provinces, India. The specimen was noticeable on account of the approximation of the antlers to those of that variety of the Thameny known as *C. eldi platyceros*. This was

shown by the circumstance that the main bifurcation took place at a much higher point than usual, and the upper tine of the fork was followed by two other tines, thus giving the appearance of the row of small tines in *C. eldi platyceros*. Moreover, the very large angle formed by the brow-tine with the beam suggested the continuous curve of the *eldi* antler. The specimen clearly demonstrated the propriety of including *C. eldi* in the same subgeneric group as *C. duvauceli*, rather than that of separating the former as *Panolia*.

A communication was read from Señor Florentino Ameghino, C.M.Z.S., containing further remarks on *Neomylodon listai* from Patagonia. He proposed to identify it with the so-called "Jemich" (or "Water Tiger") of the Tehuelche Indians. This "ferocious beast" had been referred to by Musters, 'At Home with the Patagonians,' ed. 2, pp. 104, 105 (1873). Señ. Ameghino also considered the Su or Succaroth of Lozano ('Historia de la Conquista del Paraguay,' vol. i. pp. 285, 286, 1873) to be probably the same animal.

Mr. A. Smith Woodward exhibited, on behalf of Dr. Moreno, the skull and other specimens of *Neomylodon listai* (*Grypotherium*) lately discovered in the cave in Southern Patagonia where the original pieces of skin were first obtained, and made remarks on them.

The Secretary exhibited, on behalf of Mr. C. E. Pole Carew, F.Z.S., some malformed horns of the Sambur Deer (*Cervus aristotelis*), obtained by him in the southern province of Ceylon, and read some notes on them sent by Mrs. Carew.

The following papers were read:—

1. Field-notes on the Blue Duiker of the Cape Colony (*Cephalophus monticola*). By F. Vaughan Kirby, F.Z.S.

[Received May 22, 1899.]

Although in point of numbers one of the commonest of the Colonial Antelopes, this delicate little creature is of such retiring habits, and its size is so insignificant, that less is known of it than of other Antelopes of the district. In the densely-wooded kloofs and on the hill-sides covered with low scrub and often impenetrable thorn-jungle, which form their home, it is rarely indeed that even the most skilful stalker can move with such silence and care as to be neither heard nor seen by them, even though their restless disposition causes them often to move about during those hours of daylight when most other forest-dwellers are asleep. Even in the densest bush, the spaces underneath to a height of two feet from

the ground are comparatively clear, hence the little Blue Duiker, or Blue-buck, as it is generally called, moves about in what to him is practically open bush, in which objects are visible at a considerable distance: thus the stooping, struggling form of the stalker worming a passage through an opening two feet square in an unyielding wall of thorns, or striving to free himself from the too firm embrace of a network of "wacht-een-beetje" bushes, cannot fail to attract attention long before the little grey watcher, standing motionless in the shadows, has been discovered.

At the bush-drives so common in the Colony, Blue-buck are seldom turned out; they will keep such dogs as have not learned wisdom of experience tearing round and round a kloof all day, but will never venture to break unless by chance a hard-pressed individual takes advantage of some narrow bush-strip at an unwatched, unthought-of point to escape by way of it into the next kloof. The Blue-buck may be easily bagged, however, in the early morning by the exercise of a little judgment. The direction of the wind must be studied before all things, then search must be made for the most frequented "paths" or "runs." Should one be found which is evidently a main path to and from certain feeding-grounds, this can be watched; but a surer method is to find a spot where they are accustomed to feed on the surrounding bushes. In such places many converging paths will be seen, in view of which, at a short distance down wind, the watcher must take his stand before sunrise, keeping out of sight behind a bush or fallen tree-trunk. Under such circumstances, his patience will not be severely taxed before he is rewarded by a sight of the little grey wood-elves. In localities where water is handy, the paths to and from it may be watched. In the heat of summer Blue-buck frequently drink between noon and 2 P.M., but, as is the case with the Bush-buck, in the extensive arid regions of this Colony, the want of water troubles the Blue-buck not at all; during the trying drought which has raged over the Gamtoos river district for the past fifteen months, countless numbers of both Bush-buck and Blue-buck have certainly not tasted water from one week's end to another.

In little disturbed localities I have seen Blue-buck playing about in pairs on fairly open ground bordering the kloofs as late as 8 A.M., and towards evening, during the hour before sunset, they may often be seen standing in or crossing any quiet road which passes through scrub-bush. But they are very quick, and though in the dusk they will stand watching the intruder curiously, yet before the light fails they usually scuttle off very promptly, uttering their sharp, but by no means shrill alarm whistle. They are apt soon to stand again, however, so that if silently followed up, a shot may be obtained. When lying up for the day they usually select spots overgrown with thorn-bush and other vegetation, reaching these from the more open bush, in which they feed, by regularly frequented paths.

It will be remarked that while in many respects their habits are

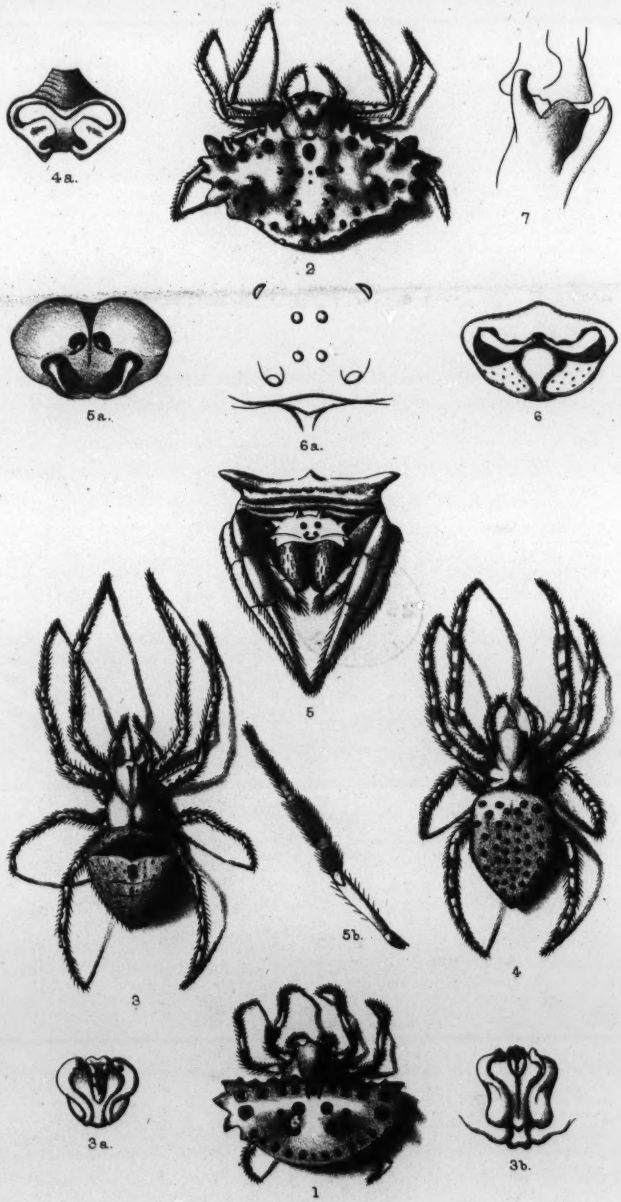
similar to those of the Red Duiker (*C. natalensis*), they entirely differ from them in their rigid avoidance of really open ground; for it is well known that the Red Duiker loves to disport himself on open grassy ridges 200 or 300 yards distant from any bush: I have shot many in such situations. "Scuttle" is a word which aptly describes the movements of a Blue-buck when alarmed: unlike *C. grimmi* and *C. natalensis*, they do not bound away, but move at a quick scuttling trot.

Blue-buck are almost entirely browsers upon bushes, and it is well known that in order to get at branches which are out of their reach when standing on the ground, they will raise themselves on their hind legs like goats, resting their fore feet against the tree-stem. Perhaps, however, the fact is now made known for the first time (if, indeed, it does not actually amount to the discovery of a hitherto unknown habit of this antelope), that the Blue-buck can and does *climb trees*! My brother Mr. E. W. Kirby witnessed this singular feat yesterday morning (21st April), when out stalking, and actually shot one as it stood on a branch, browsing on the leaves around it. He was first attracted to the spot by the low grunting sounds they were making, but, though they were evidently close by, he failed to make one out after carefully scrutinizing the surrounding bush. Advancing cautiously, he soon saw the leaves of a "boer-boon" tree [1] shaking violently, and for a moment believed it was caused by either baboons or monkeys: at last, to his surprise, he discovered a Blue-buck moving along a branch of the tree some 12 feet from the ground. Although in pursuit of Bush-buck, this opportunity of shooting a Blue-buck under such peculiar circumstances was not to be lost, so he fired and killed it. At the report of the rifle at least eight other Blue-buck dropped from the branches, apparently reaching the ground on all four legs at once, and scuttled off; while, as he stepped forward to secure the dead one, a male, another dropped apparently out of the tree under which he had knelt to fire the shot. That same morning he saw Blue-bucks in four different trees. The boer-boon tree above mentioned rose from the ground at an angle of about 50°, but the Blue-buck were not on the main trunk, but amongst the smaller branches. I regret that an accident had prevented me from being with my brother that day, as I had intended; but he assures me he will be able to point out the spot another day, when he is confident I shall an be eye-witness of this singular climbing feat.

Perhaps it will not be out of place if I here make reference to the singular little Antelope which I shot in Nov. 1896, in the Kwawa district, Portuguese East Africa. The skull is still in Mr. Rowland Ward's hand, (the skin was unfortunately amongst the valuable trophies purloined in Delagoa Bay by a notorious firm of "forwarding agents"), and was, at my request, sent by him to Mr. Sclater for examination. It was pronounced to be "apparently that of a Blue-buck," but without the skin no definite conclusion

[1] Farmers' bean-tree.

BRITISH
25 AP 1900
MUSEUM



F. O. Pickard-Cambridge del. et lith. West, Newman imp.

WEST-AFRICAN ARACHNIDA.

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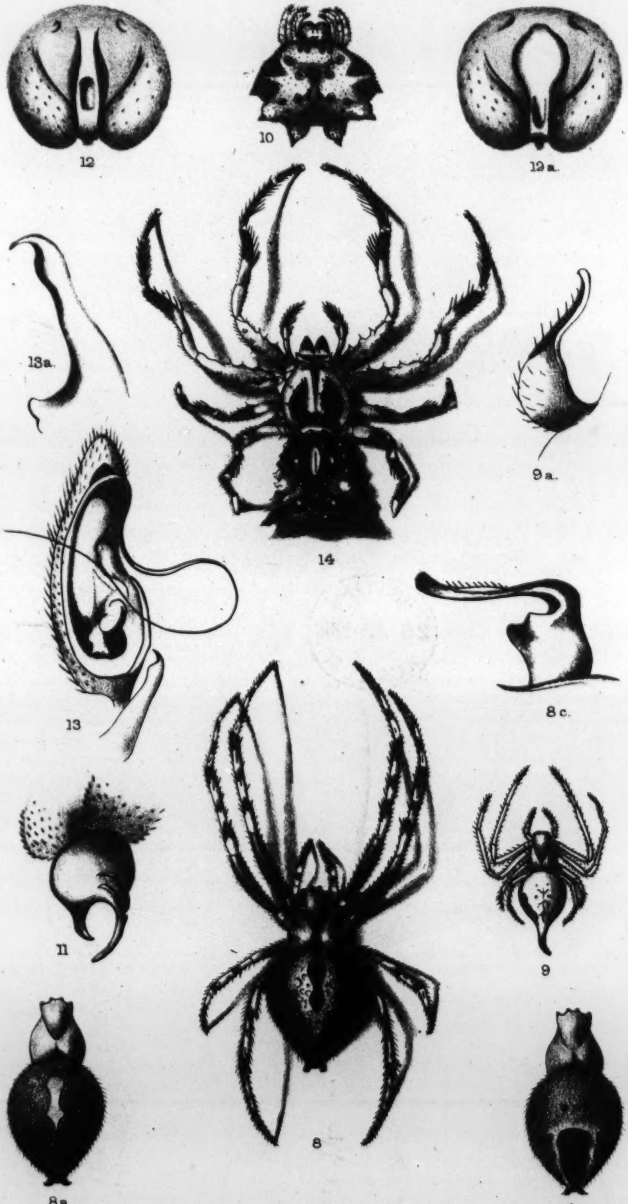

F. O. Pickard-Cambridge del. et lith. West, Newman imp.

WEST-AFRICAN ARACHNIDA.

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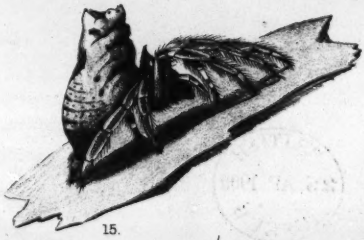

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WEST-AFRICAN ARACHNIDA.

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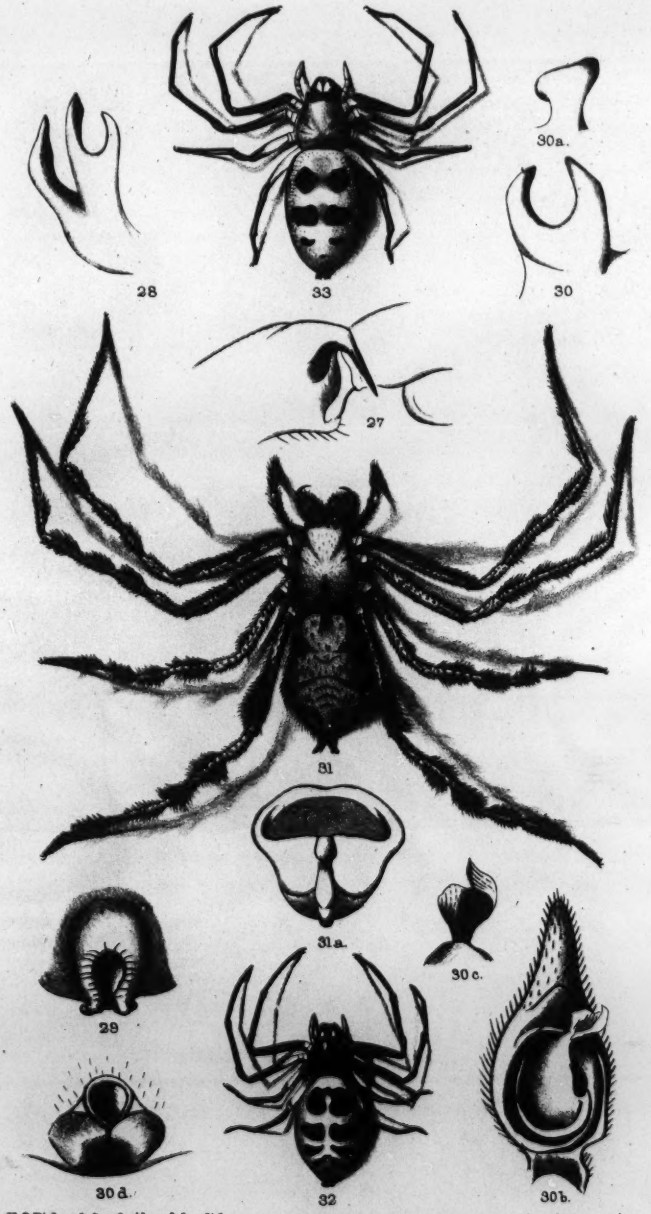


F. O. Pickard-Cambridge del. et lith. West, Newman imp.

WEST-AFRICAN ARACHNIDA.

could be arrived at. Now at the time this opinion was given my knowledge of the Blue-buck and its habits was but slight; but during my residence in the Cape Colony I have studied them very carefully, and I am now able to advance further reasons why I am convinced that this Kwawa Antelope was not *C. monticola*. At first I could only point to the entirely different coloration, the Kwawa specimen being a warm *yellowish-red*, with *pure white underparts*, and a wash of the mouse-grey colour, peculiar to *C. monticola*, on the frontals and nape of the neck; but it is now evident to me that the habits of the two are quite dissimilar, the Kwawa Antelope being very restricted in its range, more partial to open clearings, less shy, and a less pronounced browser, while its movements are springy and more resemble those of *Nesotragus livingstonianus*, for which Antelope I and my native followers at first mistook it. However, I hope soon to secure other specimens, and until then it is idle to speculate upon the subject.

2. On the Scorpions, Pedipalps, and Spiders from Tropical West Africa represented in the Collection of the British Museum. By R. I. Pocock.

[Received May 24, 1899.]

(Plates LV.–LVIII.)

With the exception of the Attidæ and of some of the more obscure species of other families, which I have not attempted to determine, this paper contains a record of the Arachnida belonging to the Orders Scorpiones, Pedipalpi, and Araneæ, now contained in the British Museum, which have been collected at various times in West Africa between Senegambia in the north and the Congo in the south. Senegambia has been fixed as the northern limit, because it is at that point that the western Ethiopian fauna blends with the western Mediterranean fauna. From the countries lying to the south of the Congo we have very little material; hence this river has been regarded as the southern limit of the area of which the fauna is discussed in the following pages.

By far the richest collection, both as regards numbers of specimens and species, that we have received from this area is the one that has been sent in instalments during the past twelve months by Mr. G. L. Bates from the Benito River in French Congo. This collector, whose name has already been frequently mentioned in the pages of the 'Proceedings' in connection with various rare mammals that he has procured, has been wonderfully successful in his search after Spiders, having sent home representatives of many new species, and added to the National Collection several others which, although previously known, had never found their way into our cabinets.

Order SCORPIONES.

Family Buthidæ.

Genus Buthus Leach.

Buthus (Prionurus) citrinus (Hempr. & Ehrenb.).

Androctonus (*Prionurus*) *citrinus*, Hempr. & Ehrenb. Symb. Phys., Scorp. no. 6, pl. ii. fig. 2.

Prionurus citrinus, Pocock, J. Linn. Soc., Zool. xxv. p. 306 (1896).

Buthus citrinus, Kraep., Das Tierr., Scorpiones, p. 16 (1899).

Loc. Senegal (*Keys. Coll.*, and several specimens procured from *Heine*).

Apparently extending right across the Saharan region from Senegal to Dongola and Upper Egypt, where it was first procured.

Buthus occitanus (Amor.).

Scorpio occitanus, Amoreux, Journ. Phys. xxv. p. 9, pl. i. figs. 1–3 (1753).

(= *occitanus* and *europæus* (Linn.) of recent authors.)

Loc. Senegal (*Heine*); Gambia (*Sir A. Moloney*).

Senegambia is the southern limit on the west of Africa of this common Mediterranean species.

Buthus hottentotta (Fabr.).

Scorpio hottentotta, Fabr. Ent. Syst. ii. p. 435 (1793).

Loc. Gambia (*Mr. Dalton*); Sierra Leone (*Surg.-Capt. Clements* and *E. E. Austen*); Shongo (*W. A. Forbes*); Niger (*Sir R. Murchison*); Asaba, 180 miles up Niger (*Dr. Crosse*).

Genus Lychas C. Koch[1].

Lychas asper (Poc.).

Isometrus asper, Pocock, J. Linn. Soc., Zool. xxiii. p. 445 (1890); Kraep. Das Tierr., Scorpiones, p. 49 (1899) (*Archisometrus*).

Loc. Congo (*J. Pinnock* and *A. Curror, Esq., R.N.*); Angola (*Dr. Welwitsch*).

Genus Uroplectes Pet.

Uroplectes occidentalis Simon.

Uroplectes occidentalis, Simon, Bull. Soc. Zool. Fr. p. 219 (1876).

Lepreus occidentalis, Poc. P. Z. S. 1890, p. 132, pl. xiv. fig. 4; id. Ann. Nat. Hist. (6) xvii. p. 388 (1896) (*Uroplectes*).

Tityus chinchoxensis, Karsch, Z. Naturw. lii. p. 370 (1879).

[1] Based by C. Koch upon two species, *L. maculatus* and *L. scutilus*, which at the present time are not regarded as congeneric. The first is the type of Hemprich and Ehrenberg's genus *Isometrus*. Consequently *L. scutilus* stands, by elimination, as the type of *Lychas*.

Kraepelin applies this system of elimination to the selection of the type of the genus *Heterometrus*, but not to *Lychas*.

Loc. Congo (*A. Curror, Esq., R.N.*, and *J. Pinnock*); Cette-Camma, Gaboon ('*Gerrard*'); Angola (*Dr. Welwitsch*).

UROPLECTES ANDREÆ, sp. n.

Nearly allied to *U. occidentalis* Simon, but recognizable by having the superior edge of the 4th caudal segment armed posteriorly with a tooth-like tubercle like that which is observable on the preceding segments, and the corresponding edges of the 5th caudal segment ending behind in a rounded bifid lobe with a vertical posterior margin; the tail, moreover, is parallel-sided, not posteriorly incrassate.

Measurements in millimetres.—Total length 58, length of carapace 6, of tail 33, of movable digit 7.

Loc. Kassai, on the Loangé River, Upper Congo (*Mr. Andrew*).

Genus BABYCURUS Karsch.

BABYCURUS BÜTTNERI Karsch.

Babycurus büttneri, Karsch, Berl. ent. Z. xxx. p. 78 (1886); Pocock, Ann. Nat. Hist. (6) xvii. p. 429 (1896); Kraep. Das Tierr., Scorpiones, p. 62 (1899).

Loc. Benito River (*G. L. Bates*), Cette-Camma, Gaboon; mouth of the Loango River (*H. Duggan*).

BABYCURUS KIRKI Poc.

Rhoptrurus kirki, Poc. Proc. Zool. Soc. 1890, p. 137.

Loc. W. Africa (*Kirk*); Lomé, Togoland (*Miller*).

BABYCURUS JOHNSTONI Poc.

Babycurus büttneri, Poc. Proc. Zool. Soc. 1890, p. 138 (not of Karsch).

Babycurus johnstonii, Poc. Ann. Nat. Hist. (6) xvii. pp. 429–430 (1896).

Loc. Rio del Rey (*H. H. Johnston*).

Genus ISOMETRUS Hempr. & Ehrenb.

ISOMETRUS EUROPÆUS (Linn.)[1].

(= *I. maculatus* De Geer, and almost all modern authors.)

Loc. W. Africa (*Dr. Kirk*); Sierra Leone (*James Foxcroft, E. E. Austen*); Fanti; Cette-Camma, Gaboon; Cameroons (*J. Pinnock*); Angola (*Dr. Welwitsch*).

[1] The evidence adduced by Lönnberg (Ann. Mag. Nat. Hist. (7) i. pp. 86–87, 1898) in favour of his view that the Scorpion described by De Geer as *I. maculatus* is the *S. europæus* of the 10th ed. of the 'Systema' appears to me to be more cogent than the evidence in favour of the identity of *Scorpio maurus* and *Scorpio australis* of the latter work. Yet Kraepelin in his 'Tierreich' accepts the two last, but rejects *S. europæus*.

Genus Centrurus (Hempr. & Ehrenb.), Pet.

Centrurus margaritatus (Gerv.).

Scorpio margaritatus, Gerv. Voy de la Bonite, i. p. 281, pl. i. figs. 13–17 (1841).

Centrurus gambiensis, Karsch, MT. Münch. ent. Ver. iii. p. 123 (1879).

Loc. Sierra Leone (*Surg.-Capt. Clements*); recorded by Karsch from Gambia.

Undoubtedly imported from America; perhaps from Jamaica, where the species is common.

Genus Pandinus Thor.

Pandinus imperator (C. Koch).

Buthus imperator, C. Koch, Die Arachniden, ix. p. 2, fig. 695 (1842).

Pandinus imperator, Kraep. Das Tierr., Scorpiones, p. 122 (1899).

(= *roeseli*, Simon; *africanus*, Linn., Thor., Poc., Kraep.)

Loc. Slave Coast (*Alvan Millson*); Gold Coast (*Col. Sir F. Festing*); Fanti (*Capt. Marryat*); Ashanti (*W. H. Adams*); 80 miles inland of Axim (*H. G. Eames*); Onitsha on the Niger (*Sir J. Marshall*); Asaba, 180 miles up the Niger (*Dr. Crosse*); Jebba and Ilo, on the Upper Niger (*Dr. Christy*, *Capt. Rigby*, and *Lieut. Abadie*); Wegbe, Ho district, Togoland (*W. G. Innes*); Fernando Po (*Mrs. Burton* and *Capt. Birch*).

Pandinus imperator (C. Koch), subsp. gambiensis nov.

? *Heterometrus imperator* (C. Koch), Simon, Rev. Mag. Zool. 1872, p. 55; Becker, Ann. Soc. ent. Belg. xxiv. pp. 137–140 (1880).

Differing from the more southern form of *P. imperator typicus* in having the carapace entirely covered with granules, the terga much more closely and thickly granular, and the ornamentation of the upper surface of the hand much more distinctly tubercular, the tubercles remaining for the most part distinct and not running together into a network of ridges. Pectinal teeth 16–18.

Total length up to about 155 mm.

Loc. Gambia (*Sir A. Moloney*; type); also several specimens from Senegal (*Heine*).

Pandinus dictator Poc.

Scorpio dictator, Poc. Ann. Mag. Nat. Hist. (6) ii. p. 251 (1888); Kraep. MT. Mus. Hamb. xi. p. 70 (1894); id. Das Tierr., Scorpiones, p. 123 (1899).

Loc. W. Africa (no history); Fernando Po (*Capt. Birch*; type); mouth of the Loango River (*H. L. Duggan*).

Genus Opisthacanthus Pet.

Opisthacanthus lecomtei (Lucas).

Ischnurus lecomtei, Lucas, in Thomson's Arch. Ent. ii. p. 428 (1858).

Opisthacanthus duodecim-dentatus, Karsch, Berl. ent. Zeit. xxx. p. 79 (1886).

[See also Pocock, Ann. Mag. Nat. Hist. (6) xii. p. 318 (1893); Kraep. Das Tierr., Scorpiones, p. 149 (1899).]

Loc. Benito River (*G. L. Bates*).

This species was not represented in the British Museum until Mr. Bates procured it.

Opisthacanthus africanus Simon.

Opisthacanthus africanus, Simon, Bull. Soc. Zool. Fr. i. p. 221 (1876).

Opisthacanthus septem-dentatus, Karsch, Z. Naturw. li. p. 372 (1878).

[See also Pocock, Ann. Nat. Hist. (6) xii. p. 316 (1893); Kraep. Das Tierr., Scorpiones, p. 149 (1899).]

Loc. Guinea (in Keyserling's Coll.); Cette-Camma, Gaboon (*Gerrard*); Congo (*A. Curror, Esq., R.N., J. Pinnock*); Stanley Falls, Congo (*Gerrard*).

Order PEDIPALPI.

Genus Titanodamon Poc.

Titanodamon bassamensis (Lucas).

? *Phalangium medium*, Herbst, Nat. ungeflügelt. Ins. i. p. 77, pl. iv. fig. 1 (1797).

Phrynus bassamensis, Lucas, Arch. Ent. ii. p. 434 (1858).

Phrynus kochii and *P. granulosus*, Butl. Ann. Nat. Hist. (4) xii. pp. 120–122 (1873).

Phrynus savatieri, Rochebrune, Bull. Soc. Philom. (7) viii. p. 28 (1884).

Titanodamon bassamensis, Poc. Ann. Mag. Nat. Hist. (6) xiv. p. 290 (1894).

Damon medius (Herbst), Kraepelin, Das. Tierr., Scorpiones, p. 238 (1899).

Loc. Sierra Leone (*H. C. Hart, Surg.-Capt. Clements, C. M. Mitford*, &c.); Dixcove in Ashanti (*B. Frend*); Cape Coast Castle (*J. P. Brown*); Asaba, 180 miles up Niger (*Dr. Crosse*); Gold Coast; Wegbe in the Ho district, Togoland (*W. G. Innes*); Jebba on the Upper Niger (*Dr. Christy*); Cameroons (*Capt. Burton*).

Titanodamon johnstoni Poc.

Titanodamon johnstoni, Poc. Ann. Mag. Nat. Hist. (6) xiv. p. 291, pl. viii. figs. 2–2*b*.

Damon medius johnstoni, Kraep. Das Tierr., Scorpiones, p. 239 (1899).

Loc. Fernando Po (*Vigors Coll.*); Old Calabar (*J. W. Cockburn* and *Miss Kingsley*); Cameroons (*H. H. & J. M. E. Johnston*, *Miss Kingsley*); Rio del Rey (*H. H. Johnston*); Benito River (*G. L. Bates*).

TITANODAMON TIBIALIS (Simon).

? *Phrynus tibialis*, Simon, Bull. Soc. Zool. Fr. i. pp. 12–15 (1876).

Titanodamon tibialis, Poc. Ann. Mag. Nat. Hist. (6) xiv. p. 291 (1894).

Damon medius tibialis, Kraep. Das Tierr., Scorpiones, p. 239 (1899).

Loc. Congo (*A. Curror, Esq., R.N.*); West Africa (*Mr. Dalton*).

Order ARANEÆ.

MYGALOMORPHÆ.

Family THERAPHOSIDÆ.

Subfamily THERAPHOSINÆ.

(=*Theraphosinæ*, *sensu stricto*, Pocock, P. Z. S. 1897, p. 772.)

Genus SCODRA Becker.

SCODRA CALCEATA (Fabr.).

Aranea calceata, Fabr. Ent. Syst. ii. p. 427.

Scodra aussereri, Becker, CR. Soc. Ent. Belg. 1879, p. cxlii; ibid. 1881, pl. ii. fig. 1.

Stromatopelma alicapillatum, Karsch, Berl. ent. Zeit. 1881, p. 218.

Scodra calceata, Pocock, Proc. Zool. Soc. 1897, pp. 755 & 756 (*sensu stricto*).

Loc. Accra (*G. A. Higlett*); Cameroons (*Capt. Burton*); Ashanti; Afram plains.

SCODRA GRISEIPES Poc.

Scodra griseipes, Poc. Proc. Zool. Soc. 1897, p. 756, pl. xliii. figs. 7–7 *a*.

Loc. Sierra Leone (*C. Wilson* and *C. M. Mitford*).

SCODRA BRACHYPODA Poc.

Scodra brachypoda, Poc. loc. cit. p. 757, pl. xliii. figs. 8–8 *a*.

Loc. Asaba on the Niger (*Dr. Crosse*); Cape Palmas (*Alvan Millson*).

SCODRA FUMIGATA, sp. n.

♀. *Colour.* Carapace and upperside of mandible clothed with bright, almost mustard-yellow or greyish-yellow hairs; upperside of femora and patellæ of palpi and anterior legs olive-yellow; tibiæ with a basal greyish-white patch and two short median lines; protarsi and tarsi with median black patch; setæ on the limbs greyish; the upperside of the fringes bordering the leg-segments greyish brown; upperside of abdomen greyish brown, with symmetrically disposed darker patches and bars; *the entire underside of legs and palpi, excepting the scopulæ, of abdomen, coxæ, and sternum deep sooty-black*; circumoral hairs crimson.

Thoracic fovea deep and subcircular; carapace distinctly shorter than patella and tibia of 1st leg, and stouter by one third of the protarsus than the tibia and protarsus of this limb; less also than patella and tibia and than tarsus and protarsus of 4th.

Legs 4, 1, 2, 3 in length; patella and tibia of 4th a little greater than of 1st, 4th leg about three times as long as the carapace; segments of legs thickly fringed.

Measurements in millimetres (♀ type).—Total length 44; length of carapace 21, width 18; length of 1st leg 60 (patella + tibia 23), 2nd leg 58 (patella + tibia 22), 3rd leg 53 (patella + tibia 9), 4th leg 64 (patella + tibia 23·5, protarsus 16).

Loc. Benito River (*G. L. Bates*).

The distinguishing characters of the females of the known species of the genus *Scodra* may be re-stated as follows:—

a. Carapace longer than patella + tibia of 1st leg and as long as tibia + protarsus of this limb ..... *brachypoda* Poc.

b. Carapace shorter than patella + tibia of 1st leg and shorter than the protarsus and tarsus of this limb by one third of the protarsus.

*a*¹. 4th leg longer than 1st and about three times as long as the carapace; patella + tibia of fourth a little longer than those of 1st; tibiæ of legs sooty black below *fumigata* sp. n.

*b*¹. 4th leg shorter than 1st and much less than three times as long as carapace; patella + tibia of 4th much less than those of 1st; tibiæ not sooty black below.

*a*². Lower and inner surface of femora of palp and of first pair of legs greyish or yellowish brown; setæ yellowish brown ..... *griseipes* Poc.

*b*². Lower side of femora of all the legs and inner surface of femora of palp and 1st and 2nd legs sooty black; bristles on legs foxy red ..... *calceata*.

Genus HETEROSCODRA, nov.

This new genus and *Scodra*, its nearest ally, may be diagnosed as follows:—

a. Fourth leg thinner than first; the tibia of 4th thinner than patella and femur, the height and width of the tibia about one quarter the length ..... *Scodra* Becker.

b. Fourth leg thicker and stronger than 1st; the tibia thick, its height a little exceeding the height of the patella, equal to that of the femur, and about one half the length of the tibia ..... *Heteroscodra*, nov.

HETEROSCODRA MACULATA, sp. n.

♀. *Colour.* Carapace covered with white hairs round the margin and furnished with narrow white stripes which radiate from the fovea to this white border, the intermediate area clothed with hairs of an olive-green tint, forming two indefinite longitudinal bands starting with a deep patch of the same tint on each side of the ocular tubercle; upperside of abdomen olive-green, mottled with white; mandibles black, covered with ashy-grey hairs; legs deep red, covered with ashy-grey hairs; the naked lines on femora, patellæ, and tibiæ very distinct; hairs on femora and tibiæ whiter than on the rest of the limbs, the distal extremities of which are clothed with foxy-red bristles, with a greenish underclothing; upperside of tibiæ with two submedian white lines or spots, on the proximal side of which there are a pair of blackish bands; a large black spot on the upperside of the tarsus and on the basal half of the protarsus, as in *Scodra*; the extremities of the segments with a narrow rim of white hairs; lower side of trunk and limbs uniform ashy grey, the scopulæ bluish green.

Carapace longer than wide, the width almost equal to the length from the anterior median eye to the posterior border. Eyes as in *Scodra*; the length of carapace a little less than patella, tibia, and tarsus of palp, a little excelling patella and tibia of 1st leg, less than those of 4th leg, equal to tibia, protarsus, and half the tarsus of the 3rd, less than protarsus and tarsus of 4th, greater than those of 1st; the width a trifle less than patella and tibia of 1st, and just exceeding those of 2nd leg.

Legs 4, 1, 2, 3, without spines, scopulate as in *Scodra*; protarsus of 4th longer than tibia of 4th, and as long as protarsus and half the tarsus of the 1st.

Measurements in millimetres.—Total length 30; length of carapace 16, width 14·5; length of 1st leg 42, of 4th 48, patella and tibia of 1st 15, of 4th 18; length of tibia of 4th 10·5, height 4·5.

Loc. W. Africa (*F. W. Marshall*).

A single female specimen of this interesting new spider was received from this Society, to which it had been presented alive by Mr. F. W. Marshall. This specimen lived for some months in the Insect-house at the Society's Gardens, and was referred to by Mr. A. Thomson as *Scodra calceata* in his report upon the Insect-house for 1897 (see P. Z. S. 1898, p. 81). Though very closely resembling *Scodra calceata* in colour, the spider was found, upon closer examination after death, to be the representative of quite a distinct species.

Genus SELENOGYRUS Poc.

SELENOGYRUS CÆRULEUS Poc.

Selenogyrus cæruleus, Poc. Proc. Zool. Soc. 1897, p. 768.

Loc. Sierra Leone (*Surg.-Capt. Clements* and *E. E. Austen*).

SELENOGYRUS AUREUS Poc.

Selenogyrus aureus, Poc. op. cit. p. 768, pl. xli. figs. 2-2 *a*.

Loc. Sierra Leone (no further history).

Hapalopus africanus Simon, from Assinie (Ann. Soc. Ent. Fr. 1887, p. 275), perhaps belongs to the genus *Selenogyrus* (see Pocock, P. Z. S. 1897, p. 774, note).

Genus MIASCHISTOPUS Poc.

MIASCHISTOPUS RAPIDUS Poc.

Miaschistopus rapidus, Poc. Proc. Zool. Soc. 1897, p. 770, pl. xli. fig. 5.

Loc. W. Africa (*Keyserling Coll.*).

Subfamily EUMENOPHORINÆ,

Pocock, Proc. Zool. Soc. 1897, pp. 772 & 773.

Genus EUMENOPHORUS Poc.

EUMENOPHORUS CLEMENTSI Poc.

Eumenophorus clementsii, Poc. Proc. Zool. Soc. 1897, p. 766.

Loc. Sierra Leone (*Surg.-Capt. Clements*).

Genus PHONEYUSA Karsch.

Phoneyusa, Karsch, Berl. ent. Zeit. 1884, p. 347 (type *P. belandana* Karsch).

Harpaxotheria, Simon, Actes Soc. Linn. Bord. 1889, p. 413 (type, *H. antilope* Simon).

The species of Spiders here and in my previous paper on the African fauna referred to *Phoneyusa* have been identified as belonging to that genus on the strength of M. Simon's statement (Hist. Nat. Araignées, i. p. 154, 1892) that the type species of *Phoneyusa* and *Harpaxotheria* are congeneric.

Nevertheless it is possible that the two forms will prove generically separable. If Karsch's description of *P. belandana* is reliable, that species differs from all the species which I refer to *Phoneyusa* and which doubtless belong to *Harpaxotheria*, in the strict sense of the word, in the following features:—

a. Carapace about one third longer than broad (34 : 22½); sternum also about one third longer than broad (15½ : 10½); tibiæ of legs with many apical spines, 8-9 on the 1st and 2nd, 4 on the 3rd and 4th..... *belandana* Karsch.

b. Length of carapace and sternum exceeding the respective widths by less than one quarter of the length; tibiæ of legs in ♀ at most with a pair of apical spines ..... *antilope* Sim. *occidentalis*, Luc., *büttneri*, Karsch (? spinal armature).

But although there is thus a possibility of resuscitating *Harpaxtheria*, it must be remembered that the apparently greater narrowness of the cephalothorax in *P. belandana* may be due to artificial shrinkage, and that too great stress should not be laid upon the tibial spine-armature, seeing that in the male of *P. gregorii*, which is apparently congeneric with *P. antilope* and *P. occidentalis*, the tibia of the 1st leg is armed with 5 spines, the 2nd with 3, and the 3rd and the 4th with 2 each.

Again, before *Harpaxotheria* be rescued from the world of synonyms, it will have to be ascertained that it is distinguishable from Karsch's previously established genus *Pelinobius*, a point about which great doubt may be entertained.

PHONEYUSA OCCIDENTALIS (Lucas).

Mygale occidentalis, Lucas, Thomson's Arch. Ent. ii. p. 380 (1858).

♀. *Colour.* Integument of carapace, mandibles, and legs uniform deep reddish brown, covered with deep olive-green hairs; the distal segments of the palpi and of the first two pairs of legs much redder in the young; femora, patellæ, tibiæ, and protarsi with a fringe of yellowish-pink hairs at their distal extremities; abdomen greenish brown; the long bristles on the legs and abdomen reddish.

Carapace considerably longer than patella and tibia of 4th and 2nd legs, a little longer than those of 1st, longer than tarsus and protarsus of 4th, much longer than those of 1st, a little longer than patella, tibia, and tarsus of palp; its width a little less than the area between the posterior emargination and the ocular tubercle, much exceeding the 4th protarsus and just exceeding protarsus and tarsus of 1st leg, a little longer than femur of 4th leg.

Legs 4, 1, 2, 3; 4th exceeding 1st by one fourth the length of its tarsus; tibiæ with a pair of distal spines below, protarsus of 1st with 1 median apical spine, of 2nd with 3 spines, of 3rd and 4th with about 9 spines in a transverse row.

Measurements in millimetres.—Total length 62; length of carapace 32, width 26; length of palp 47, of 1st leg 78, of 2nd leg 69, of 3rd leg 63, of 4th leg 79, patella and tibia of 1st 30, of 4th 27, protarsus of 4th 21 (legs and palpi measured from base of femur).

In younger females the legs are much longer as compared with the carapace than in the adult.

Loc. Benito River (*G. L. Bates*).

This species has not been hitherto recognized since it was first established.

It certainly differs from *P. belandana* Karsch (Berl. ent. Zeit. 1884, p. 348), from Niam Niam in Central Africa, in having only a pair of spines at the apex of the tibiæ, instead of a large number as in *P. belandana*; that is to say, 9 on the 1st tibia, 8 on the 2nd, &c. In *P. belandana* also the sternum is nearly twice as long as wide (15 : 8), whereas in *P. occidentalis* the length is only a little greater than the width (9 : 7·5). In the character of the sternum *P. occidentalis* resembles *P. büttneri* Karsch (Berl. ent. Zeit. 1886, p. 83), from

Sibange Farm, Gaboon, with which it may prove to be identical. Karsch, however, says nothing about the colouring of *P. büttneri*, nor about the spine armature of the legs.

From *P.* (*Harpaxotheria*) *antilope* Simon (Act. Soc. L. Bordeaux, xlii. p. 414, 1889), from Tomby in the Congo, *P. occidentalis* also differs, judging by the leg-measurements that Simon gives. For example, the 4th leg in the type of *P. antilope* exceeds the 1st by about 10 mm. (63·2: 53·5), that is to say, by considerably more than the length of the tarsus of either limb, whereas in *P. occidentalis* the difference does not amount to more than half the tarsus.

PHONEYUSA BIDENTATA, sp. n. (Plate LVI. fig. 11.)

♂. *Colour*: a uniform dull greyish-brown clothing of hairs on the trunk and limbs, the long bristles on the legs and abdomen reddish grey, the integument beneath the hairs nearly black; a narrow fringe of pale pinkish hairs at the distal end of the femora, patellæ, tibiæ, and protarsi.

Carapace longer than wide, its length slightly exceeding that of patella, tibia, and tarsus of palp, equal to protarsus and femur of 4th leg, considerably less than patella and tibia of 4th leg, a little greater than patella and tibia of 3rd leg, its width just about equal to femur of 2nd.

Legs long and slender (those of 1st pair absent), with two or three spines at the apex of tibiæ beneath, about 4 on apex of 2nd protarsus, and a row of about 8 on apex of 3rd and 4th protarsi; 4th leg exceeding the 2nd by about two thirds of its protarsus, patella and tibia of 2nd about equal to those of 4th, the tarsi about equal; tarsus of 4th, including claw, about equal to patella of 4th; bristles upon legs and abdomen hooked at their distal ends. Tibia of *palp* about three times as long as broad; bulb of palpal organ subcircular and furnished with *two* spines, the principal spine rather short, stout, not filiform, furnished externally with two keels which pass on to the bulb, the smaller spine in front of the larger, much smaller than it and curved in the opposite direction.

Measurements in millimetres.—Total length 41; length of carapace 23, width 20·5; length of palp 35, of 2nd leg 74, of 3rd 65, of 4th 80, patella and tibia of 4th 27; protarsus of 4th 23·5, tibia of 4th 18, tarsus 9.

Loc. Benito River (*G. L. Bates*).

This species differs from all the known species of *Phoneyusa* that are based upon male examples in the possession of a second spiniform process on the bulb of the palpal organ.

These species are *P.* (*Harpaxotheria*) *gracilipes* Simon, from the Congo, and *P.* (*Harpaxotheria*) *ectypa* Simon, from Abyssinia (Act. Soc. L. Bordeaux, xlii. pp. 414–415); *P. gregorii* Pocock (Proc. Zool. Soc. 1897, p. 760, pl. 43. fig. 6), from Masailand, and *P. bettoni* Pocock (Proc. Zool. Soc. 1898, p. 503), from the area between Mombasa and Uganda.

Genus Hysterocrates Simon.

Hysterocrates gigas Poc.

Hysterocrates gigas Poc. loc. cit. p. 762.

Loc. Cameroons (*J. M. C. Johnston*); Oil River (*H. H. Johnston*).

Hysterocrates laticeps Poc.

Hysterocrates laticeps Poc. loc. cit. p. 765, pl. xli. figs. 4–4 *b*.

Loc. Old Calabar (*Miss Kingsley*).

Hysterocrates crassipes Poc.

Hysterocrates crassipes, Poc. loc. cit. p. 764, pl. xli. fig. 4 *c*.

Loc. Cameroons (*H. H. Johnston*).

Hysterocrates hercules, sp. n.

♀. *Colour*. Integument black, covered with a thick coating of dark olive-brown hairs, shining with greyish silky sheen under reflected light.

Carapace a little longer than patella and tibia of 1st and of 4th leg, longer than tarsus and protarsus of 4th and than patella, tibia, and tarsus of palp; its width equal to length from tubercle to posterior emargination and to femur and patella of 3rd leg, and to femur and one third of patella of 4th leg; a transverse depression in front of fovea, marking off a transversely oval tubercle.

Mandibles tubercular in front.

Legs 4, 1, 2, 3; 4th exceeding 1st by nearly half its tarsus; patella and tibia of 4th not longer than of 1st; 4th leg not in any sense thickened, femur more than three times as long as high (25 : 7·8), thicker than patella, which is considerably thicker and higher than tibia; tibia slightly concave below and in the basal half above, more than three times as long and wide as high (17·8 : 5·2); length of upperside of patella more than twice its height or width.

Measurements in millimetres.—Total length 74; length of carapace 34, width 30; length of palp 49, of 1st leg 81, 2nd leg 72, 3rd leg 67, 4th leg 88; patella and tibia of 1st 33, of 4th 32; tarsus and protarsus of 4th 31.

Loc. Jebba, Upper Niger (*Lieut. Abadie*).

Recognizable from the other known species of the genus by its large size, darker colouring, and by having the 4th leg unmodified, not thicker than the 1st, and only exceeding it in length by less than half its tarsus.

Hysterocrates robustus, sp. n.

♀. *Colour* olive-greenish brown, with reflexions of greyish-white pubescence.

Carapace considerably longer than wide, the width equal to the distance between the ocular tubercle and the median emargination; the length equal to that of patella and tibia of 4th leg, greater than those of 1st and greater than tibia and protarsus of 1st; the width

slightly exceeding the length of the outer surface of the femur of the 4th leg.

Legs 4, 1, 2, 3; 4th exceeding the 1st by rather more than the length of its tarsus; patella and tibia of 4th a little longer than of 1st (24 : 22); 4th leg strong, but the patella and tibia narrower than the femur; width and height of patella about equal, but barely equal to half the length measured along the upperside; tibia lightly convex above, its width a little greater than one third of its length and a little less than its height; protarsus longer than tibia (15·5 : 13·5); femur of 4th leg very robust, its height exceeding one third of its length.

Measurements in millimetres.—Total length 53; length of carapace 24, width 20; length of 1st leg 55, of 2nd 49, of 3rd 4, of 4th 65; length of femur of 4th leg 18·5, height 7; length of the tibia 13·5, height 5.

Loc. Benito River (*G. L. Bates*).

The subjoined table will show how this species may be distinguished from the rest of the species of *Hysterocrates* known to me:—

a. Width of tibia of posterior leg equal to that of femur; tarsus of palp more tumid above at base ..... *crassipes* Poc.
b. Width of tibia of posterior leg much less than width of femur; tarsus not tumid above at base.
  a^1. Carapace long; area between ocular tubercle and posterior median emargination exceeding the width ... *gigas* Poc.
  b^1. Carapace wider, its width equal to the area between the tubercle and the posterior emargination.
    a^2. Femur of 4th leg slender, its height barely one third of its length.
      a^3. Hairy clothing of legs reddish brown; 4th leg thickened, the tibia almost as thick as the femur. *laticeps* Poc.
      b^3. Hairy clothing deep olive-brown; 4th leg unmodified, the tibia much thinner than the femur ..... *hercules*, sp. n.
    b^2. Femur of 4th leg stout, its height considerably exceeding one third of its length..... *robustus*, sp. n.

Family Barychelidæ.

Genus Cyphonisia Simon.

Cyphonisia obesa Simon.

Cyphonisia obesa, Simon, Act. Soc. L. Bordeaux, xlii. p. 409 (1889).

Loc. Benito River (*G. L. Bates*).

Two immature specimens probably referable to this species, which was recorded from the Rio Quiliou (Congo).

Family Diplurida.

Genus Heterothele Karsch.

Heterothele, Karsch, SB. nat. Fr. Berlin, 1879, p. 64; Pocock, Proc. Zool. Soc. 1897, p. 736.

? HETEROTHELE GABONENSIS (Lucas).

Mygale gabonensis, Lucas, Arch. Ent. 1858, p. 382.
? *Diplura longipalpis*, Karsch, Zeits. Naturwiss. (3) iv. p. 564.

Two female specimens of a species referable to *Heterothele*, obtained by G. L. Bates on the Benito River, are regarded as probably identical with *Mygale gabonensis*, Lucas.

Family CTENIZIDÆ.

Genus ACANTHODON, Guér.

ACANTHODON ANGUSTICEPS, sp. n.

♀. Very closely resembling, both in size and spine-armature, &c., *A. lacustris*, Pocock (Proc. Zool. Soc. 1897, p. 731, pl. xli. fig. 7), from Lake Tanganyika. The two species may be separated as follows:—

a. Carapace broader as compared with its length (7·8 : 9), width equal to the distance between the posterior border and the anterior border of the ocular cluster; the two ocular tubercles higher, the area behind the posterior considerably more depressed owing to the greater elevation of the cephalic prominence; sternum wider as compared with its length (4·8 : 5); legs longer, length of 1st 18·8, of 4th 23, tarsus and protarsus of 4th 8; palp from base of femur 16, its three distal segments 9·8 ..... *lacustris* Poc.

b. Carapace narrower, its width as compared with its length being 6·8 : 9, width equal to the length between the posterior border and posterior edge of the ocular tubercle; ocular tubercle lower, but little elevated, area behind the ocular cluster but little depressed; sternum narrower, very distinctly narrower than long (4 : 5); legs shorter, length of 1st 17, of 4th 22, tarsus and protarsus of 4th 7; of palp 15, its three distal segments 9 .. .. *angusticeps*, sp. n.

Slight differences also are observable in the eyes, the posterior medians being a little closer together, more directly behind the medians and a little farther from the laterals. I have very little confidence, however, in the taxonomic value of slight apparent differences in the size and relative positions of these organs.

Loc. Benito River (*G. L. Bates*).

A single female example was procured.

ARACHNOMORPHÆ.

Family DINOPIDÆ.

Genus DINOPIS Macleay.

DINOPIS BUBO Brit. Capello.

Dinopis bubo, Brit. Capello, Mem. Ac. Sci. Lisboa, (3) iv. pt. 1: Arachnideos etc. p. 16, pl. ii. fig. 3.

Loc. Gaboon.
Recorded from the River Quilo.

DINOPIS ASPECTANS, sp. n.

♀. *Colour.* Carapace yellowish brown, covered with whitish hairs, reddish hairs around the eyes; mandibles pale yellow, sparsely speckled with black, scantily clothed with yellow hairs; mouth-parts yellow; sternum yellow, blackish at the sides, mottled with yellow and white hairs; palpi yellowish brown, mottled with black; legs brownish, femora infuscate distally, the anterior pairs also infuscate beneath and spotted with black at the base of the spines above, patellæ fuscous, tibiæ distally infuscate, 3rd and 4th pairs with superior distal spot, protarsi yellowish indistinctly speckled with black; abdomen clothed laterally and below with whitish hairs, with four white spots and two parallel lines on the area between the epigastric fold and the cribellum; the upper surface covered with darker hairs, with a low crest of hairs passing transversely in front of the prominences and curving backward on the sides.

Carapace nearly twice as long as wide, its length equal to that of tibia of 3rd leg, a little more than one third that of the 1st protarsus, less than half (about two fifths) the length of the 1st femur; cephalic area a little wider in front than behind; superciliary ridges evenly rounded, not prominent or produced into horn or tooth; the posterior median eyes close together, their radius exceeding the height of the clypeus, anterior medians about two diameters apart.

Palpi very slightly longer than carapace.

Legs 1, 2, 3, 4; 1st twice as long as 3rd, 1st exceeding the 2nd by half its protarsus and its tarsus; 3rd reaching to apex of tibia of 2nd when both are extended; on the femora of the 1st and 3rd the anterior spines are supported on tubercles which also support small tufts of hair.

Abdomen rather more than twice as long as wide, posteriorly pointed and compressed, widest just in front of the middle, where it rises into a pair of prominences, from which it narrows anteriorly and posteriorly.

Measurements in millimetres.—Total length 19; length of carapace 7, width 4; length of abdomen 12, width 5; length of 1st leg 58, of 2nd 45, of 3rd 29, of 4th 28.

Loc. Benito River (*G. L. Bates*); a single ♀ example.

This new species may be at once recognized from *D. anchietæ* (*Dinopis anchietæ*, Brit. Cap. *loc. cit.* p. 15, pl. ii. figs. 2–2 *c*), from Rio Quilo, Angola, by the absence of triangular superciliary crests, the greater length of legs, flatter and longer carapace, proximity between posterior median eyes, &c. In *D. anchietæ* the eyes are concealed by the crests when viewed from above and are nearly a radius apart; the thoracic portion of the carapace is as wide as long, and although the length of the trunk is about the same as in *D. aspectans*, the anterior leg measures only 41 mm. instead of 58.

Family Argiopidæ.

Genus Nephila Leach.

Nephila femoralis (Lucas).

Epeira femoralis, Lucas, Thomson's Arch. Ent. ii. p. 38, pl. xii. fig. 4 (1858).

Nephila vittata, Keys. SB. Isis, Dresden, 1863, p. 142, pl. ii. fig. 2.

Loc. Sierra Leone (*Surg.-Capt. Clements*); Liberia (*Keyserling Coll.*, type of *N. vittata*); Gold Coast (*T. E. Bowdich*); Ashanti (*W. H. Adams*); Asaba, 150 miles up Niger (*Dr. Crosse*); Accra and Wassan (*G. A. Higlett*); Cameroons (*Capt. Burton, Miss Kingsley*); Old Calabar (*Miss Kingsley, H. A. Spencer*); Benito River (*G. L. Bates*); Stanley Falls, Congo; Angola.

Nephila lucasi Simon.

Epeira chrysogaster, Lucas, Thomson's Arch. Ent. ii. p. 35 (not *chrysogaster*, Leach).

Nephila lucasi, Simon, Ann. Soc. Ent. France, 1887, p. 270.

Loc. Sierra Leone (*Surg.-Capt. Clements*); Ashanti (*Mr. Macarthy*); Accra (*G. A. Higlett*); Cameroons (*Capt. Burton, Miss Kingsley*); Benito River (*G. L. Bates*); Wathen on the Congo (*Miss Macormick*).

Nephila pilipes (Lucas).

Epeira pilipes, Lucas, Thomson's Arch. Ent. ii. p. 40, pl. xiii. fig. 7.

Loc. Fantee, Accra (*G. A. Higlett*); Benito River (*G. L. Bates*).

Nephila bragantina Brit. Capello.

Nephila bragantina, Brit. Capello, Mem. Ac. Sci. Lisboa, (3) iv. pt. 1: Descripcão de algunas especies de . . . . Arachnideos, p. 11, pl. ii. fig. 4.

Loc. Braganza, interior of Angola (*Brit. Cap.*).

The British Museum has no examples of this species from W. Africa, but has received specimens of apparently the same form from Kinyamholo, Lake Tanganyika (*A. Nutt*). *N. bragantina* differs from *N. keyserlingii* Blackw. (=*hymenœa* Gerst.) in having the palpi black, the legs black with the exception of a yellow band at the tip of the tibia and base of protarsus of 1st and 2nd legs, and no dark band in the middle of the sternum.

Nephila cruentata (Fabr.).

Araneus cruentatus, Fabr. Ent. Syst. ii. p. 427 (1793).

Nephila genualis, Gerst. Von der Decken's Reisen, iii. 2, p. 502 (1873).

Loc. Sierra Leone (*D. F. Morgan, Surg.-Capt. Clements*); Ashanti (*Mr. Macarthy*); Onitsha on the Niger (*Sir J. Marshall*); Old Calabar (*H. A. Spencer*); Congo (*J. Pinnock*); Stanley Falls, Congo.

The following W. African species of this genus is unknown to me:—

NEPHILA CONSTRICTA Karsch.

Nephila constricta, Karsch, Zeits. gesammt. Naturwiss. lii. p. 834, fig. 4 (1879).

Loc. Loango coast.

Genus ARGIOPE Aud. et Sav.

ARGIOPE FLAVIPALPIS (Lucas).

Epeira flavipalpis, Lucas, Thomson's Arch. Ent. ii. p. 49 (1858).

Argiope flavipalpis, Brit. Capello, Jorn. Sci. Lisboa, i. p. 83, pl. ii. fig. 2 (1866).

Argiope pechueli, Karsch, Zeits. gesammt. Naturwiss. lii. p. 340 (1879).

Loc. Sierra Leone (*Surg.-Capt. Clements*); Old Calabar (*Miss Kingsley*); Cameroons (*Capt. Burton* and *Sir Harry Johnston*); Benito River (*G. L. Bates*).

The legs of this species vary in tint: sometimes they are noticeably striped black and yellow, as in the form to which Karsch gave the name *pechueli*, and sometimes of a very much darker, more uniform hue as in the typical *A. flavipalpis*. The two forms occur at the same locality, and gradations in the coloration of the legs are traceable. I therefore regard *A. pechueli* as a synonym of *A. flavipalpis*.

ARGIOPE NIGROVITTATA Thorell.

Argiope nigrovittata, Thorell, Œfv. Vet.-Akad. Förhandl. p. 300 (1860).

Argiope caudata, Blackwall, Ann. Mag. Nat. Hist. (3) xvi. p. 346 (1865).

Argiope zairiensis, Brit. Capello, Jorn. Sci. Lisboa, i. p. 82, pl. ii. fig. 1.

Argiope suavissima, Gerstäcker, Von der Decken's Reisen, iii. 2, p. 495, pl. xviii. fig. 10 (1873).

Loc. Congo; Benguela (*J. J. Monteiro*).

Genus ARANEUS Linn.

ARANEUS RUFIPALPIS (Lucas).

Epeira rufipalpis, Lucas, Thomson's Arch. Ent. ii. p. 422 (1858).

Epeira semiannulata, Karsch, Zeits. gesammt. Naturwiss. lii. p. 334 (1879) (♀); Simon, Bull. Soc. Zool. France, ix. p. 14, pl. ii. figs. 7–8 (1884) (♂, ♀).

? *Epeira penicillipes*, Karsch, loc. cit. p. 836 (♂).

Loc. Sierra Leone (*Surg.-Capt. Clements*); Accra (*G. A. Higlett*); Cameroons (*Capt. Burton*); Benito River (*G. L. Bates*). This species also occurs on the eastern side of the continent of Africa.

It appears to me that the descriptions given of *E. rufipalpis* and

E. semiannulata were based upon examples belonging to the same species. Karsch's figure of the palp of *E. penicillipes* resembles that organ in male examples of *E. rufipalpis* sent by Mr. Bates.

ARANEUS THEÏS (Walck.).

Epeira theïs, Walckenaer, Ins. Apt. ii. p. 53.

Epeira moreli, Vinson, Aranéides de Madagascar, etc. p. 166, pl. iv. fig. 4 (1863).

Epeira eclipsis, Marx, Proc. U. S. Nat. Mus. xvi. p. 590, pl. lxx. figs. 6 *a*–6 *b*.

This widely distributed tropical species was recorded from the Congo as *Epeira eclipsis* by Marx. The British Museum has no W. African representatives of it, but has received it in some abundance from Mashonaland (*G. A. K. Marshall*).

ARANEUS PACHANUS Poc.

Araneus pachanus, Poc. Ann. Mag. Nat. Hist. (7) vii. p. 447, pl. xiii. fig. 9 (1898).

Loc. Benito River (*G. L. Bates*). Several ♀ examples.

Previously recorded from Karagesi (*Emin Pasha*) and Ruwenzori (*Scott Elliot*).

This species presents a striking likeness, both in colour, form, and structural details, to the Oriental species that has been described as *A. decens*, *rumpfi*, *rufofemoralis*, &c. But the shape of the vulva seems to separate the African species, the scape being longer and the basal portion much more prominent beneath it.

ARANEUS HÆMATOCNEMIS, sp. n. (Plate LVI. figs. 8–8 *c*.)

Colour. Carapace either a uniform blackish brown or reddish brown above, passing into black towards the margins; upperside of abdomen either uniformly blackish brown or ornamented with yellow on the anterior half—the yellow taking the form sometimes of a median field pointed in front and behind, broadest across the shoulder region, breaking up into spots all round its margin and interrupted along the middle line by an irregular black stripe; sometimes of a sharply defined median stripe, broadest in front and constricted in the middle and at the posterior end; sometimes of a transverse recurved stripe behind the large sigilla, the extremities of which extend backward as an indistinct yellow stripe on each side circumscribing a median jet-black area which occupies the position of the folium. (In a young specimen the abdomen is testaceous, with jet-black folium and bright yellow median constricted stripe in front of it.) Sides and lower surface of abdomen black. Sternum, labium, maxillæ, and mandibles deep blackish brown; legs with coxæ and femora uniformly blackish brown; patellæ, tibiæ, and protarsi darker or lighter red, with their distal ends black, and frequently a median band; tarsi black, with narrow red basal band.

Carapace moderately elevated; fovea subcircular, with longitu-

dinal groove in front of it, somewhat as in *Larinia*; length o carapace exceeding that of 1st tibia, equal to that of 4th protarsus and tarsus and to patella, tibia, and half the protarsus of 3rd leg; width equal to length of 4th tibia and to 4th protarsus, less than that of 1st or 2nd tibia; median ocular tubercle prominent. Ocular quadrangle much wider in front; the posterior eyes much smaller than the anterior and nearly a diameter apart; anterior medians about a diameter apart, more than a diameter from the posterior medians and from the edge of the clypeus; eyes of anterior line when viewed from the front procurved, the upper edge of the laterals scarcely on a level with the centre of the medians; lateral eyes not quite in contact.

Mandibles moderately geniculate at the base; fang-groove armed with 4 anterior and 3 posterior teeth.

Legs armed with many strong spines; spines black at the base and apex, reddish in the median portion.

Abdomen heart-shaped, longer than broad, widely rounded in front, without shoulder-points, narrowly ovate behind, not surpassing spinners. *Vulva* with scape long and bent at right angles, its base as wide as the basal vertical, vestibular portion, which, when viewed from the side, is seen to send out a bitubercular prominence beneath the scape, from which it is separated by a narrow notch.

Measurements in millimetres.—Total length 22; length of carapace 9, width 7·2; length of abdomen 14, width 12; length of 1st leg 34, of 2nd 33, of 3rd 19, of 4th 30; patella and tibia of 1st leg 13, of 4th 11; tibia of 1st leg 8, of 4th 7.

Loc. Benito River (*G. L. Bates*).

Mr. Bates procured many specimens of this handsome species.

ARANEUS ERESIFRONS Poc.

Araneus eresifrons, Poc. Proc. Zool. Soc. 1898, p. 509, pl. xli. figs. 3–3 *b*.

Loc. Cameroons (*H. H. Johnston*).

Previously recorded from Karagesi (*Emin Pasha*), Likipia (*J. W. Gregory*), Taru (*Steuart Betton*), and Mombasa (*D. J. Wilson*).

This species is certainly nearly allied to *A. strupifer* Simon (Ann. Soc. Ent. France, 1885, p. 368), which, according to Simon, occurs both in Senegal and Cape Colony.

In the specimens from the Cameroons the abdomen is frequently variegated above with sooty black, a type of coloration not observed in the East-African forms known to me.

ARANEUS TYLOSCAPUS, sp. n. (Plate LV. figs. 3–3 *b*.)

Colour. Carapace testaceous; cephalic region with blackish spots; legs testaceous, with small black spots; patellæ, tibiæ, protarsi, and tarsi banded with black; mandibles testaceous; sternum, labium, and maxillæ infuscate; abdomen olive-yellow, variegated with blackish, marked above with five transverse black lines, the anterior of which is the strongest and runs from one shoulder-point to the

other, with its convexity backwards; inferior and lateral surfaces darker than the superior, the inferior with a pair of yellowish posteriorly dilated bands running from the stigmata posteriorly towards the spinning-mammillæ.

Eyes of anterior and posterior line recurved when viewed from above, those of anterior line also strongly recurved when viewed from the front, the laterals standing much higher than the medians; median quadrangle a little wider than long, nearly twice as wide in front as behind, the posterior separated by a very narrow space which barely equals half their radius, the anterior separated by a space which is equal to their diameter.

Legs armed with numerous spines arranged in more or less definite rows; there being, for example, 6—6 on the lower side of the tibiæ and protarsi of the 1st and 2nd legs; spines black at base, pale distally.

Abdomen longer than wide, widely rounded in front, oval behind; with distinct black-tipped shoulder-processes, covered with short white hairs, intermixed with particoloured bristles.

Basal part of *vulva* very stout when protruded, and consisting of a right and left outer sheath, the halves of which do not meet in the middle line. Viewed from below, the two halves of the outer sheath show as a right and left rim surrounding a central pale portion, upon which rests the short but broad scape, the anterior part of which divides the rim of the right side from that of the left. The posterior end of the scape does not project so far posteriorly as the posterior border of the subjacent portion of the vulva.

Measurements in millimetres.—Total length 12; length of carapace 5, of abdomen 9, width of latter 7·5.

Loc. Benito River (*G. L. Bates*).

In the form of its vulva and other features this species is evidently related to *A. suedicola* Simon, from Arabia and (according to Pavesi) from Somaliland, to *A. mossambicensis*, Pavesi, from Mozambique, to *A. similis* and *striata*, Bösenberg and Lenz, from Quilimane, and to *A. cyrtoscapus* Poc., from the Transvaal.

ARANEUS RHINURUS, sp. n. (Plate LVI. figs. 9, 9 *a*).

Colour. Carapace olive-brown, clothed with yellow hairs; mandibles, palpi, and legs almost the same colour as the carapace; distal end of femora, tibiæ, protarsi, and the tarsi infuscate, especially on the 3rd and 4th legs; upperside of abdomen chalky yellow, with dark sigilla spots and fine black line between them, also with a fine reticulated ornamentation of lines between the low pigment-spots; the tail and the lower side of abdomen black, with symmetrical bright yellow spots on each side of the spinners.

Carapace shorter than tibia 1, about as long as patella and tibia 4; cephalic region moderately elevated, flattish above longitudinally; ocular quadrangle almost square, scarcely narrowed in front. The eyes large and subequal, posterior medians about a

diameter apart, anterior medians a little more than a diameter apart, distance between anterior and posterior medians less than a diameter; anterior line of eyes straight or nearly so; anterior medians less than their diameter from the edge of the clypeus.

Legs longish, scantily spined, but furnished with long close-set bristles; the spines setiform; 1st leg much longer than 4th.

Abdomen flat above, heart-shaped, with rounded antero-lateral angles and anterior border, the posterior apex prolonged into a longish, stout "tail," which about equals the carapace in length; spinners in the middle of the heart-shaped basal portion of the abdomen.

Vulva with its basal vestibular portion not expanded, either laterally or posteriorly, at the base of the scape, which is long, slender, and slightly curled at the tip.

Measurements in millimetres.—Total length 9; length of carapace 2·5, of abdomen 6·5, of abdomen without tail 4, width of abdomen 3·5; length of 1st leg 12, of 4th 8.

Loc. Benito River (*G. L. Bates*). A single adult female.

This differs from all the Tropical African species of *Araneus* known to me in having the ocular quadrangle approximately square, with the four eyes subequal, and the extremity of the abdomen produced into a longish caudal process. In both of these features it resembles the Burmese species *A. thelurus* (Thor.), but may be at once separated from it at least by the much greater length of the scape of the vulva.

Genus Cyrtophora Sim.

Cyrtophora citricola (Forsk.).

Loc. Benito River (*G. L. Bates*).

Widely distributed throughout Tropical Africa and Asia.

Cyrtophora angolensis (Brit. Capello).

Epeira angolensis, Brit. Capello, J. Ac. Sci. Lisboa, i. p. 79, pl. ii. fig. 4 (1868).

Epeira chinchoxensis, Karsch, Zeits. gesammt. Naturwiss. lii. p. 333 (1879).

Loc. Sierra Leone (*Surg.-Capt. Clements*); Benito River (*G. L. Bates*).

Recorded by Brito Capello from the Rio Quilo. Karsch's specimens from Chinchoxo appear to me to be specifically identical with those that Capello described.

M. Simon (Hist. Nat. Araignées, i. p. 775, 1895) adds this species to the synonymy of *C. citricola*. But this is undoubtedly an error, *C. angolensis*, according to my determination, being distinguishable by the posteriorly pointed abdomen and wide head, with the lateral eyes far apart from the medians. The vulva is furnished with a distinct process.

Three well-marked colour-varieties of this species are met with.

In one the upperside of the abdomen is entirely black; in a second it is also black with a bright yellow transverse stripe crossing it from shoulder to shoulder; in the third, which seems to be less prevalent than the others, the whole of the upperside behind the anterior shoulders is yellow.

CYRTOPHORA LARINIOIDES Simon.

Cyrtophora larinioides, Simon, Ann. Soc. Ent. France, 1894, p. 155.

Loc. Benito River (*G. L. Bates*).

Described from Ogowé.

CYRTOPHORA MARGARITATA, sp. n. (Plate LV. figs. 4, 4 *a*.)

Colour almost as in *C. unicolor* Dol., a tolerably uniform yellowish brown; the abdomen darker than the carapace and limbs, legs indistinctly variegated, sternum and lower side of abdomen blackish.

Carapace smooth as in *C. citricola*; eyes as in the latter species, but the laterals closer together.

Legs as in *C. citricola*, but with tarsi and protarsi shorter; tarsus and protarsus of 1st, for example, being distinctly shorter than patella and tibia of 1st.

Abdomen truncate in front, narrowly ovate behind, not lobate laterally, and only weakly bilobate posteriorly, as in *C. angolensis*; studded above with larger and smaller smooth circular bosses, very like those of *C. unicolor*, but much larger and less numerous.

Vulva as in figure (Pl. LV. fig. 4 *a*).

Measurements in millimetres of type.—Total length 14; length of carapace 6·5, of abdomen 9, width of abdomen 7·5; length of 1st leg 19, its patella and tibia 7, protarsus and tarsus 6.

Loc. Benito River (*G. L. Bates*).

At once recognizable from *C. unicolor* by the strong curvature of the posterior line of eyes, narrow interval between the lateral eyes, absence of tubercles on the carapace, large size of tubercles on the abdomen, &c. From the rest of the W.-African species known to me it may be at once recognized by the features mentioned in the subjoined table.

The four W.-African species of *Cyrtophora* known to me may be distinguished as follows:—

a. Abdomen long and narrow, produced in front into a longish process overhanging the base of the carapace..... *larinioides* Sim.

b. Abdomen truncate in front, broadest at its anterior end.

a^1. Abdomen without distinct shoulder prominences and no lateral prominences; its upperside studded with large circular tubercles..... *margaritata*, sp. n.

b^1. Abdomen with distinct shoulder prominences and one or more prominences on each side; upperside studded with smaller tubercles.

a^2. Abdomen with one prominence on each side behind the shoulder, posteriorly deeply bifid;

eyes of posterior line strongly recurved; vulva without scape..... *citricola* Forsk.

b^2. Abdomen with two prominences on each side behind the shoulder prominence, apex of abdomen not bifid; posterior line of eyes much less strongly recurved; vulva with distinct scape..... *angolensis* B. Cap.

Genus ARGYROEPEIRA Emerton.

ARGYROEPEIRA UNGULATA (Karsch).

Meta ungulata, Karsch, Zeits. ges. Naturwiss. lii. p. 834 (1879).

Loc. Benito River (*G. L. Bates*).

This species, recorded from the Loango coast, also occurs on the eastern side of the African continent.

Genus CYCLOSA Menge.

CYCLOSA INSULANA (Costa).

Loc. Cameroon Mountains, 4000 ft. (*H. H. Johnston*).

Genus ACUSILAS Sim.

? ACUSILAS AFRICANUS Sim.

?*Acusilas africanus*, Sim. Hist. Nat. Araignées, i. p. 785 (1895).

Loc. Benito River (*G. L. Bates*).

The description of *A. africanus* is too brief to make sure of the correctness of the identification of the immature female of a species of this genus which Mr. Bates procured. M. Simon's example was obtained at Sierra Leone.

? Genus SALASSINA Sim.

SALASSINA FORMOSA (Karsch).

Cyclosa formosa, Karsch, Zeits. ges. Naturwiss. lii. p. 835 (1879).

Loc. Cameroon Mountains, 4000 ft. (*H. H. Johnston*).

Recorded by Karsch from the Loango coast.

According to M. Simon's division of the Cycloseæ, this species, if rightly determined, as I think is the case, falls apparently nearest to the genus *Salassina*, having the head short, the median eyes of large size and the quadrangle they form slightly narrowed in front. The tibiæ of the legs, however, are not noticeably incrassate, and there are no angular prominences on the fore part of the abdomen. The lesser recurvature of the eyes and the absence of a median series of spines from the lower side of the protarsus of the 4th leg seem to exclude the species from the allied genus *Acusilas*.

Genus CÆROSTRIS Thorell.

CÆROSTRIS ARGOSTICTUS, sp. n. (Plate LV. figs. 5–5 *b*.)

Colour. Carapace with thoracic portion reddish above, with a silvery white patch at the sides; cephalic portion blackish, with an

oblong silvery patch of hair on the upperside between the ocular tubercle and the posterior vertical tubercles, and a silvery patch on the upperside of the lateral tubercles; mandibles deep brown; sternum bluish black, with central silvery patch; maxillæ and labium black; coxæ of legs deep brown with bluish tint; trochanters and femora red; remaining segments nearly black, with bluish lustre especially below; a white band at base of tibiæ and protarsi below, the tibial band broad only on the 1st leg, also a conspicuous white tarsal band on 4th leg; palp with femur red, the other segments blackish with white spots above. Abdomen blackish above and below, yellow at the sides anteriorly, the upperside with a vertically interrupted transverse silver band behind the anterior row of tubercles, and a series of silvery patches and lines forming a longitudinal median band extending over two thirds of the upper surface between the transverse silvery band and the posterior tubercle; sides of upper surface with narrow transverse silvery stripes; lower surface with a row of three silvery spots on each side, extending from the epigastric fold to the sides of the spinning-mammillæ.

Cephalic tubercles long, subspiniform, much longer than ocular tubercle. Length of carapace equal to width of head, including ocular tubercles, and as long as protarsus of 1st leg, shorter than protarsus and tarsus of 4th leg by at least half the length of the tarsus.

Abdominal processes normal in number, as, for example, in *C. mitralis*, and all small and tuberculiform; the bifid projection above the spinners rather prominent.

Tibiæ and protarsi of *legs* normally impressed above.

Vulva as in figure (Pl. LV. fig. 5 *b*).

Measurements in millimetres.—Total length 14; length of carapace 6, of abdomen 10, width of abdomen 11.

Loc. Benito River (*G. L. Bates*).

Easily recognizable from the S. and E. African species of the genus by the form of the vulva, and by colour, the almost complete absence of the white band at the base of the tibia on the 2nd, 3rd, and 4th legs being exceptional.

CÆROSTRIS ALBESCENS, sp. n. (Plate LVII. fig. 16.)

Allied to the East-African *C. nodulosa* Pocock (P. Z. S. 1898, p. 514, pl. xli. fig. 7).

Hairy clothing of head mesially white, laterally golden yellow; upperside of abdomen covered with greyish-white hairs, diversified with black spots on the tubercles, sigilla, and elsewhere, and with narrow transverse black lines which laterally unite, circumscribing transversely elongate pentagonal areas; lower side of abdomen black; femora steel-blue; upperside of patella, tibia, protarsus, and tarsus covered with silvery-white hairs, and varied with pale golden yellow; extremity of protarsus of 1st and in a lesser degree of 2nd leg slightly infuscate; 3rd and 4th legs more diversified than 1st and 2nd: legs banded below as in *C. nodulosa*;

tibiæ of all with basal white band; protarsus of 1st and 3rd black, with basal band of 2nd and 4th white with black patch just beyond middle.

Carapace with superior and lateral tubercles longer than in *nodulosa*.

Abdomen (in type-specimen) not distended, its anterior portion low, nodular, not elevated.

Vulva (as in figure Pl. LVII. fig. 16) somewhat resembling that of *nodulosa*, the anterior portion completely divided into a right and left half by a deep median groove; the chamber containing the two fossæ smaller, more transversely oblong, with anterior rim less arched.

Total length 15·5 mm., width of head 7·5 mm.

Loc. Benito River (*G. L. Bates*).

Cærostris turriger, sp. n. (Plate LVII. figs. 15, 15 *a*.)

Colour. Dorsal surface of carapace, legs, and abdomen a tolerably uniform greyish brown, covered with a coating of yellow and white hairs intermixed; abdomen mottled with black spots and brownish patches and lines; legs coloured as in *C. albescens*, but the distal spot on the protarsi reddish brown.

Carapace with tubercles as in *C. albescens*. Abdomen with its anterior portion elevated into a high, broad, subcylindrical prominence, the summit of which is about one third broader than long, with semicircularly rounded anterior tubercular border, and three large tubercles on the posterior border.

Vulva as in figure (Pl. LVII. fig. 15 *a*).

Measurements in millimetres.—Total length 16; width of head 7; height of abdomen from vulva to summit of prominence 13.

Loc. Benito River (*G. L. Bates*); also young specimens of probably the same species from Sierra Leone (*Surg.-Capt. Clements*).

Somewhat resembling *C. petersi* Karsch from Inhambane (Mon. Ak. Berlin, 1878, p. 324, pl. i. fig. 7), in the elevation of the anterior portion of the abdomen; but in *C. petersii* the column is narrower, with the summit rounded and not encircled with tubercles.

The three species of the genus known from the Benito River may be diagnosed as follows :—

a. Femora of legs bright red; tibiæ of 2nd, 3rd, and 4th legs with scarcely a trace of basal white band; black underside of abdomen ornamented with three pairs of silvery spots; upperside of abdomen velvety black, furnished with silvery lines and patches ..... *argostictus*.

b. Femora steel-blue; tibiæ of 2nd, 3rd, and 4th legs with broad white basal band below; lower side of abdomen uniformly black, upperside dirty yellowish brown.

*a*¹. General colour of dorsal surface of body and legs white; abdomen not elevated in front into a high thick column ..... *albescens*.

*b*¹. General aspect dirty yellowish brown; abdomen elevated in front into a broad thick column..... *turriger*.

Genus Cladomelea Sim.

Cladomelea longipes (Cambr.).

Cyrtarachne longipes, O. P. Cambridge, P. Z. S. 1877, p. 559, pl. lvi. fig. 1.

Loc. San Salvador, Congo.

Genus Gasteracantha Sund.

Gasteracantha curvispina Guérin.

Gasteracantha curvispina, Guérin, Icon. Règ. Anim., Arachn. pl. ii. fig. 8, (1837).

Gasteracantha walckenaerii, Lucas, Thomson's Arch. Ent. ii. p. 425, pl. xii. fig. 7 (1858).

Gasteracantha vaccula, Thorell, Œfv. Vet.-Akad. Förhandl. xvi. p. 301 (1859); id. Eug. Resa, Zool. Arachn. p. 12 (1868).

Gasteracantha retracta, Butler, Trans. Ent. Soc. 1873, p. 157, pl. iv. fig. 12.

Loc. Benito River (*G. L. Bates*); Sierra Leone.

Gasteracantha connata Butl.

Gasteracantha connata, Butler, Trans. Ent. Soc. 1873, p. 168.

Loc. Old Calabar (*Gray*).

Closely allied to the Ceylonese *G. geminata* Fabr., but with no near affinity to *G. connata* Simon (Hist. Nat. Araignées, i. p. 847, 1894), which the author makes the type of section O of his subdivisions of the genus *Gasteracantha*.

Gasteracantha formosa Vins., subsp. nana Butl.

Gasteracantha nana, Butl. Trans. Ent. Soc. 1873, p. 161, pl. iv. fig. 4.

Loc. Congo (type, without further history).

The type of this species is young.

G. importuna and *G. molesta*, O. P. Cambr. (P. Z. S. 1879, p. 286, pl. xxvi. fig. 1, and pl. xxvii. fig. 13), from W. Africa, are probably the adult forms.

Gasteracantha batesi, sp. n. (Plate LVI. fig. 10.)

? *Gasteracantha connata*, Simon, Ann. Soc. Ent. Fr. 1887, p. 266 (nec *G. connata*, Butl.).

Colour. Carapace black, with a large pale spot on each side of the median eyes; mandible shining black or red; sternum and coxæ fuscous, indistinctly variegated; legs yellowish brown, indistinctly annulated, tips of tarsi and protarsi black; upperside of abdomen yellow, with a large anterior median brown spot marked with a thin yellow stripe like an inverted T, and on each side a black spot divided by a narrow transverse yellow stripe; the rest of the upper surface variegated brown and black.

Cephalic area elevated behind, the middle of the elevation forming a pair of close-set tubercles.

Legs short; patella and tibia of 1st less than width of head.

Abdomen without inferior tubercle; the anterior lateral spines minute and lying far back behind the middle of the scutum and just in front of the posterior laterals, from the supporting prominence of which, however, they are separated by a rounded notch; the anterior border lying between these anterior spinules widely and nearly evenly convex, forming an almost completely semicircular arch defined by the normal 10 sigilla, of which the 4 medians form a straight transverse line; posterior lateral spines erect, very short, but borne upon the summit of a thick cylindrical prominence, the axis of which cuts that of the spines at an obtuse angle; posterior spines resembling the posterior laterals, but their axis in a line with that of the prominence and directed straight backward.

Measurements in millimetres.—Total length of abdomen along middle line 6; width just in front of anterior spinule 9·5; width from tip to tip of postero-lateral spine 8.

Loc. Benito River (*G. L. Bates*).

This species seems to form a new section of the genus *Gasteracantha*.

GASTERACANTHA (ÆTROCANTHA) ROGERSI O. P. Cambr.

Gasteracantha rogersi, O. P. Cambr. P. Z. S. 1879, p. 292, fig. 23 (♂).

Gasteracantha (*Ætrocantha*) *semiflava*, Simon, Ann. Soc. Ent. Fr. 1887, p. 268, pl. vi. fig. 2 (♀).

Loc. Sierra Leone.

Described from Assinie by M. E. Simon, and from Coanza by O. P. Cambridge.

GASTERACANTHA (ISOXIA) PENIZOIDES Simon.

Isoxia penizoides, Simon, Ann. Soc. Ent. Fr. 1887, p. 269, pl. vi. fig. 4.

Loc. Benito River (*G. L. Bates*).

Recorded by Simon from Assinie.

The foregoing species of *Gasteracantha* may be tabulated as follows:—

a. Lower side of abdomen with large conical tubercle; spines large.
  a^1. Anterior and median spines subequal and in contact ..... *connata*.
  b^1. Anterior and median spines unequal and widely separated.
    a^2. Spines with strong recurvature ..... *curvispina*.
    b^2. Spines not or scarcely recurved ..... *formosa*.
b. Lower side of abdomen without tubercle; spines absent or short.
  a^3. Spines present.
    a^4. Anterior border of abdomen widely convex; anterior spines lying far back close to and much smaller than the median spines; head tuberculate above ..... *batesi*.
    b^4. Anterior and lateral borders of abdomen cutting at right angles the anterior spines, as large as the medians and widely separated from them; head not tuberculate ..... *rogersi*.
  b^3. Spines absent; abdomen widely rounded behind ..... *penizoides*.

Genus Aranæthra Butler.

Aranæthra cambridgei Butl.

Aranœthra cambridgei, Butler, Tr. Ent. Soc. 1873, p. 175, pl. iv. fig. 8.

Aranœthra ungari, Karsch, Zeits. gesammt. Naturw. li. p. 322, pl. ix. fig. 1 (1878).

Loc. Fernand Vas River (*Du Chaillu*; type); Lagos (*Capt. Elmes*); W. Africa; Fernando Po (*Mr. Kalbreger*); Accra (*G. A. Higlett*); Loango River (*H. L. Duggan*); Benito River (*G. L. Bates*).

Aranæthra butleri, sp. n. (Plate LV. fig. 1.)

Colour. Carapace, mandibles, mouth-parts, sternum, and coxæ reddish yellow; patella, tibia, and tarsus of palp black; legs black, the femur of 1st and part of 2nd reddish; tibiæ of 1st, 2nd, and 4th pairs with a broad basal yellow ring, the ring incomplete below on the 1st; upper and lower side of abdomen and the tips of the lateral prominences black; sigilla reddish.

Carapace and legs as in *A. cambridgei*. *Abdomen* of much the same form also as in that species, about twice as wide as long; the median portion of the anterior border simply emarginate, with a low tuberculiform prominence on each side; lateral portion of carapace furnished with five blunt conical lobes, one on the anterior border just in front of the antero-lateral sigillum, the posterior process lower than the others; the entire convex posterior border of the abdomen for a space which exceeds half the length of the abdomen without tubercles; abdominal integument punctured as well as striolate; sigilla very large, the six on the middle of the back arranged in a circular form, the quadrangle formed by the anterior and posterior pairs only, about twice as long as wide.

Measurements in millimetres.—Length of abdomen 7, width 16.

Loc. Benito River (*G. L. Bates*).

This interesting new species, which is dedicated to Dr. A. G. Butler, the describer of the genus *Aranœthra*, may be recognized from the typical and hitherto only known species of the genus by the following characters:—

a. Carapace, sternum, legs, &c. a rich dark red or black colour; underside of abdomen entirely black, a black band across the fore part of the abdomen above; margin of abdomen furnished with at least 8 strong sharp spiniform processes, the posterior not very far from the posterior middle line; sigilla much smaller.	*cambridgei* Butl.
b. Carapace, sternum, coxæ, &c. reddish yellow; tibiæ of 1st, 2nd, and 4th legs with a yellow band; abdomen flavous below and without anterior black band above; abdomen furnished with only 5 lateral blunt tubercles, the posterior of these being far from the middle of the posterior border; sigilla very large.....	*butleri*, sp. n.

ÆTHRODES, gen. nov.

Allied to *Aranæthra*, but differing in the following particulars:—

a. Four median eyes elevated on a rounded tubercle; lateral eyes also on a tubercle; clypeus equal in height to half the length of the ocular quadrangle, which is longer than broad; abdomen only overlapping the posterior third of the carapace up to the median tubercle, its anterior and lateral margins armed with smooth rounded tubercles; its upper surface furnished with about a dozen symmetrically arranged various-sized tubercles ..... *Æthrodes.*

b. Ocular tubercles low, ocular quadrangle slightly wider than long; clypeus very low, less than half the ocular quadrangle; abdomen overlapping the posterior two thirds of the carapace, armed marginally with strong spines, without tubercles above ..... *Aranæthra.*

ÆTHRODES MAMMOSA. (Plate LV. fig. 2.)

Colour of abdomen a nearly uniform ochre-yellow; cephalothorax darker.

Abdomen twice as broad as its median length; its anterior border sinuous, mesially emarginate, armed with seven tubercles, not including the large tubercle on the antero-lateral angle; a large tubercle on the postero-lateral angle and two smaller lateral tubercles in front of it; the posterior border widely convex, with a series of vertical tubercles just above it and one pointed posteriorly close to the large postero-lateral tubercle; the sigilla deeply impressed and mostly subcircular; tubercles arranged as shown in Plate LV. fig. 2.

Vulva consisting of a semicircular depression in front and a narrow transverse plate above the genital aperture.

Measurements in millimetres.—Length of abdomen 12, width 22·5; length and width of carapace 7; length of 1st leg 18.

Loc. Benito River (*G. L. Bates*).

TETRAGNATHA Latr.

TETRAGNATHA CLAVIGERA Simon.

Tetragnatha clavigera, Simon, Ann. Soc. Ent. Fr. 1887, p. 272.

Loc. Benito River (*G. L. Bates*).

One female specimen referred to this species, recorded by Simon from Assinie.

Family OXYOPIDÆ.

Genus PEUCETIA Thorell.

PEUCETIA LONGIPES, sp. n. (Plate LVII. fig. 17.)

Colour (in alcohol). Carapace pale green, thoracic portion sometimes tinted with brownish, a few black spots marking the position of setæ on the head; side of head with an indistinct or distinct vertical fuscous stripe running to the basal spot on the mandible and continued as a short stripe on the upper part of that appen-

dage, the mandibles otherwise unstriped; sternum green; legs yellow; all the segments, including coxæ and trochanters but not the tarsus, spotted with black at the base of the spines and also at the base of the large hairs on the femora, coxæ, and trochanters. Abdomen greenish; a pair of yellow stripes on the ventral surface running from the epigastric fold to the spinners, and a pair of broader stripes of the same colour on the dorsal side, separated by an elongate greenish area, which is marked in front by yellow stripes running obliquely forwards and inwards and meeting in the middle line, and behind by yellow spots or stripes continued like the anterior stripes from the lateral yellow bands.

Clypeus scarcely vertical, the angle it forms with the upper surface of the head slightly obtuse; carapace as long as tarsus of 1st leg, longer than patella, tibia, and tarsus of palp, a little shorter than tibia of 3rd leg, a little more than half the length of the protarsus of the 1st.

Abdomen long, broad in front, narrow behind, more than twice as long as broad.

Legs very long; the 1st more than six times as long as the carapace; 4th a little less than five times as long, armed with long black spines.

Measurements in millimetres.—Total length 19·5; length of carapace 6·5, of 1st leg 42, of 2nd 37, of 3rd 27, of 4th 30.

Loc. Loango (*in the Keyserling Collection*). Several female specimens.

Differs from all the African species known to me in the form of the vulva; further differs from *P. pulchra* Blckw. and *P. foliifera* Butl. (?= *P. striata* Karsch) in having no black bands on the front of the clypeus and mandibles, and from *P. luteiceps* Simon (Donaldson Smith, 'Unknown African Countries,' p. 391) in having the ocular area less prominent, a single black stripe at the sides of the head and upper end of the mandible.

Family Lycosidæ.

Genus Ocyale Aud.

Ocyale atalanta Sav.

Loc. Accra (*G. A. Higlett*); Benito River (*G. L. Bates*).
Distributed throughout Tropical Africa.

Family Pisauridæ.

Genus Tetragonophthalma Karsch.

Tetragonophthalma phylla Karsch.

? *Dolomedes exilipes*, Lucas, Thomson's Arch. Ent. ii. p. 385 (1858).

Tetragonophthalma phylla, Karsch, Zeits. gesammt. Naturwiss. li. p. 329, pl. ix. fig. 4 (1878).

Loc. Sierra Leone (*Surg.-Capt. Clements*); Benito River (*G. L. Bates*).

The web of this spider has been thus described by Surg.-Capt. Clements :—"Fig. 71 is from a photograph of a web which had a height of between 6 and 7 feet. There were some half-dozen of them built in a partially cleared space in the forest. The bottom part of the web is in the form of an inverted widely-spread funnel, the top being truncated, leaving a circular aperture of three quarters of an inch in diameter. The spider lived beneath the cone, and gained access to the upper portions of his snare by the hole in its top. Numerous threads arose from the funnel and were attached to an overhanging branch more than 6 feet above." ('Science Gossip,' 1893, p. 116, fig. 71.)

It appears to me to be not improbable that this species is based upon adult examples of that which Lucas described as *Dolomedes exilipes*.

Genus Phalæa Simon.

Phalæa ferox, sp. n. (Plate LV. fig. 6, 6 *a*.)

Colour. Carapace ochre-yellow, sparsely clothed with yellowish hairs, with a narrow blackish-grey margin, some white hairs at the sides of the head and reddish hairs between the eyes; legs ochre-yellow, clothed with ashy-grey hairs, which become blacker towards the extremities; mandibles black, scantly clothed with yellowish-grey hairs; sternum blackish, clothed, like the maxilla and labium, with black hairs; upper surface and sides of abdomen clothed with reddish-yellow hairs, its lower surface with greyish-black hairs.

Carapace about one-fourth longer than broad, its length about equal to that of tibia of 2nd leg and to protarsus of 1st and 4th legs and to femur, patella, tibia, and half the tarsus of the palp; its width equal to tibia or protarsus of 3rd leg and almost equal to patella, tibia, and tarsus of palp. Cephalic region high, convexly rounded from before backwards and from side to side; ocular quadrangle much longer than wide, parallel-sided, the eyes subequal and about a diameter apart, the distance between an anterior and a posterior median of the same side equal to about two diameters, anterior and posterior laterals of either side more than twice as far apart as anterior and posterior medians; anterior and posterior laterals situated on small tubercles; anterior laterals about their own diameter above the edge of the clypeus; anterior medians about their diameter above it.

Mandibles long; the fang-groove armed with four teeth along its posterior edge.

Legs long and strong, 1, 2, 3, 4; the 1st more than four times as long as the carapace, measured from base of femur; patellæ unspined, except for a setiform spinule at the extremity of the upperside; tibiæ of 1st and 2nd armed with 4 pairs of spines below and 2 behind and 2 in front; tibiæ of 3rd and 4th with

3 pairs of inferior spines, 2 behind, 2 in front, and 1 above; femora serially spined above.

Abdomen oval, as wide as high, not twice as long as broad. *Vulva* as in figure.

Measurements in millimetres.—Total length 30; length of carapace 13, width 10; length of ocular area 3, posterior width 4; length of palpus 16, of 1st leg 52, of 2nd 51, of 3rd 39, of 4th 48; patella and tibia of 1st 19·5, of 4th 17.

The two known species of this genus, *P. canescens* and *P. vulpina* Simon (Ann. Soc. Ent. Belg. xlii. p. 10, 1898), from the Congo, are too briefly described to be identifiable. Both are smaller than *P. ferox*, *P. canescens* being 20 mm. long and *P. vulpina* 22 mm.

Genus Thalassius Simon.

Thalassius guineensis (Lucas). (Plate LVII. fig. 18.)

Olios guineensis, Lucas in Thomson's Arch. Ent. ii. p. 405, pl. xiii. fig. 6 (1858).

♀. *Colour.* Carapace with narrow black rim, covered above and laterally with a mixture of white and brown hairs, sometimes the white predominating, sometimes the brown; no distinct white marginal or submarginal band; the clypeus the same tint as the sides of the head; abdomen a deep rich-brown or greyish brown above, darker behind than in front, covered with a mixture of whitish and reddish-brown hairs, sometimes the white, sometimes the brown predominating; ornamented with four pairs of symmetrically-disposed blood-red patches, the posterior patches often indistinct; no lateral pale band; lower surface tolerably uniform yellowish brown; legs a tolerably uniform greyish or brownish hue, not banded; the protarsus sometimes darker at the tip.

Carapace just about equal to tibia of 1st and to tibia and protarsus of 4th leg; longer by about one-fourth of the tarsus than metatarsus of 1st; its upper surface flat, as high behind as in front.

Legs robust, thickly plumose, 4, 1 and 2, 3 in length; patella and tibia of 4th a little less than those of 1st, and distinctly less than those of 2nd.

Lateral lobes of *vulva* long, oblique, converging posteriorly and meeting in a short median suture; the depression between them semioval, widely open in front, and filled in with a completely chitinous irregular sclerite (see Plate LVII. fig. 18).

♂. Resembling ♀ in colour; legs much longer, but equally strongly plumose. Palp when extended not reaching apex of femur of 1st leg; its tibia subcylindrical, unarmed; tarsus piriform, shorter than patella and tibia taken together.

Measurements in millimetres.—♀. Total length 24; length of carapace 11, of 1st leg 42, 2nd leg 42·5, 3rd leg 39, 4th leg 44.

♂. Total length 22; length of carapace 10, of 1st leg 52, 2nd 52·5, 3rd 48, 4th 54.

Loc. Benito River (*G. L. Bates*).

This species has apparently not been rediscovered since Luca

described it in 1858. Hence its generic position has remained a matter of doubt.

THALASSIUS FORMOSUS, sp. n. (Plate LVII. fig. 19.)

♀. Resembling the preceding in its robust, thickly plumose legs, form of vulva, &c.; but differing essentially in colour. Side of carapace covered with a thick coating of yellow hairs, with a narrow brown inferior band above the black border; upperside mostly covered with deep-brown hairs, which on each side invade and break the continuity of the lateral yellow posterior area. Clypeus brown, the brown area sharply defined at the sides by the yellow hair clothing the sides of the head. Upperside of abdomen yellow and rich olive-brown, the latter arranged in distinct patterns, forming a posterior median patch, in front of which there are five transverse stripes, the anterior broader than the posterior; also small deep brown spots scattered here and there on the yellow, and the blood-red patches noticeable on *guineensis* also present. Upperside of legs yellow, banded with brown; femora with a broad basal brown band and a narrower band of the same colour, about one fourth of the distance from the apex; patella brown, slightly yellow distally; base of tibia narrowly, apex more widely brown; base and apex of protarsus and of tarsus brown.

Measurements in millimetres.—Total length 21; length of carapace 10, 1st leg 35·5, 2nd leg 36, 3rd leg 33, 4th leg 38.

Loc. Benito River (*G. L. Bates*).

Although not quite adult, the type of the species shows the same form of vulva as in subadult examples of *T. guineensis*.

THALASSIUS INORNATUS, sp. n.

♀. *Colour* much as in *T. guineensis*; carapace and abdomen covered with a uniform mixture of brown and yellowish-grey hairs; abdomen ornamented posteriorly at the sides with some blood-red patches running into ill-defined stripes; integument of abdomen olive-yellow, with a median anterior pale narrow lanceolate area; legs uniformly brown, covered with greyish-white hairs.

Carapace a little less than tibia of 1st and 4th and than protarsus of 4th leg, slightly longer than protarsus of 1st.

Legs much less thickly plumose than in *guineensis*; patella and tibia of 4th a little less than those of 1st.

Lower side of *abdomen* covered with short slender hairs, interspersed amongst the normal hairy coating.

Lateral lobes of *vulva* irregularly subquadrate; the inner edge longitudinally truncate and almost contiguous throughout their length, being merely separated for a short distance anteriorly by a narrow median sclerite; anterior depression of vulva marked with a pale membranous spot on each side, and on the inner side of the spot with a black, thickly chitinous ridge.

Loc. Benito River (*G. L. Bates*).

In colour, &c., closely resembling the Somaliland species *T. unicolor* Simon (in Donaldson Smith's 'Through Unknown African

Countries,' p. 389, 1897). The latter, however, has the lower side of the abdomen covered with setæ, which are longer and more numerous than in *T. inornatus*; there are no blood-red markings on the abdomen, and the depression of the vulva has no pale lateral spot and black ridge.

THALASSIUS AURATUS, sp. n. (Plate LVII. fig. 20.)

Colour. Carapace uniformly covered, except on the clypeus which is brown, with pale hairs, white at the sides and becoming yellowish on the summit; abdomen covered above with golden-yellow hairs and marked in its posterior half with some small symmetrical brown spots; sides of abdomen brownish red, darker above than below, lower surface bright yellowish brown; legs uniformly deep chocolate-brown.

Carapace as long as protarsus and one-fourth of the tarsus of the 1st leg, slightly shorter than tibia of 1st and than tibia and protarsus of 4th.

Vulva very like that of *T. regalis*, but the anterior depression filled in at the sides and leaving a longitudinally oblong median depression.

Loc. Benito River (*G. L. Bates*). A single adult female.

Recognizable from the other species by the uniform golden-yellow colour of the upperside of abdomen and carapace, and uniformly deep brown legs.

THALASSIUS LEUCOSTICTUS, sp. n.

Colour of carapace brown, with a broad yellow band on each side running from the clypeus almost to the posterior border, its upper edge tolerably even, the lower irregularly jagged on a level with the coxæ of the 2nd and 3rd legs, where the space between the stripe and the lateral margin is widest; a few small white spots on the dorsal surface of the carapace and one on each side above the anterior extremity of the stripe. Abdomen a deep rich velvety brown above, with a broad yellow stripe on each side, the stripe straight throughout its length, not geniculate, but at its posterior end irregularly jagged above, forming incipient white spots; anterior part of upper surface of abdomen with a few symmetrically arranged yellow spots; sides of abdomen below the stripe spotted with yellow; legs and palpi brown, spotted with yellow stripes above, protarsi in addition ringed with darker bands; lower side of legs, sternum, and mandibles a tolerably uniform fawn-brown; lower side of abdomen a little darker than sternum, with a few white spots at the sides.

Carapace shorter than the 1st and 4th tibiæ and not quite so long as the 4th protarsus, longer than the 1st protarsus; width of carapace just about equal to tibia of 3rd leg. Ocular quadrangle longer than wide, shorter than height of clypeus; posterior median eyes larger than anterior medians.

Legs 4, 2, 1, 3, strongly and normally spined; protarsi not very noticeably plumose.

Measurements in millimetres.—Total length 14; length of carapace 6·8, width 5·8; length of 1st leg 27·5, of 2nd 28, of 3rd 23·5, of 4th 29.

Loc. Benito River (*G. L. Bates*).

Resembling *T. spinosissimus* Karsch, from the same area, in colouring, but recognizable, according to the description of the latter, in having the legs ornamented with white transverse stripes and spots.

Although the type of this species is not quite adult, the colouring will probably be found to afford a better criterion of its specific distinction than the form of the vulva.

THALASSIUS LEONENSIS, sp. n. (Plate LVII. fig. 21.)

Colour a uniform reddish brown above and below; carapace and abdomen with a silvery white band extending from the sides of the clypeus almost to the spinners, the band on the carapace considerably narrower than the brown margin external to it.

Carapace normally high, as high behind as in front, its width equal to the area between the posterior border and the posterior lateral eye; its length equal to length of tibia or protarsus of 4th leg; slightly exceeding tibia of 1st and 2nd, width slightly exceeding tibia of 3rd.

Vulva practically as in *T. spenceri* F. Cambr., from Cape Colony (see P. Z. S. 1898, pl. iv. fig. 1 *b*), but longer as compared to its width owing to the greater length of the lateral lobes.

Measurements in millimetres.—Total length 21; length of carapace 9·5, width 8; length of 1st leg 35, of 2nd 35·5, of 3rd 33, of 4th 38; tibia of 4th 9·5, protarsus of 4th 9·8.

Loc. Sierra Leone.

The type of this species is the specimen from Sierra Leone referred by Mr. F. Cambridge to *T. spenceri*, the type of which came from East London in Cape Colony (P. Z. S. 1898, p. 30). The two specimens appear to me, however, to be specifically distinguishable. In *T. spenceri* the carapace is very slightly shorter than tibia 1 (not longer as stated in the synopsis: *loc. cit.* p. 29), and barely exceeds the 1st protarsus, and the width of the carapace is a shade less than tibia 3; the lobes of the vulva, too, are shorter and smaller.

THALASSIUS BATESI, sp. n.

General characters as in *T. leonensis*, but with yellow band on carapace and abdomen broader. Vulva differing in that the hairy lateral lobes do not meet in the middle line, but are separated in front by a median shining hairless sclerite, which is itself divided by a central longitudinal sulcus.

Measurements in millimetres.—Total length 22; length of carapace 9·2, width 7·5; length of 1st leg 36, 3rd 32, 4th 39; protarsus of 1st 8, of 4th 9·8.

Loc. Benito River (*G. L. Bates*).

Only the female known.

THALASSIUS REGALIS, sp. n. (Plate LVII. fig. 22.)

Colour. Carapace and abdomen with a pair of broad yellow bands extending from clypeus to spinners, covered elsewhere with yellowish rusty-red hairs; legs strongly banded; femora of legs yellowish red, those of 2nd pair slightly, of 3rd and 4th pairs distinctly banded with black; apex of femora, whole of patellæ, basal seventh and apical third of tibiæ, basal and apical fourth of protarsi and tarsi black; the rest of the legs yellowish red.

Carapace a little less than tibia of 1st leg, excelling its protarsus by about one fourth the tarsus, distinctly shorter than both tibia and protarsus of 4th. Lobes of vulva in contact along the posterior half of the inner edge, separated in the anterior half by a median heart-shaped sclerite, the depression in front of the lobes marked with two posteriorly converging black ridges.

Measurements in millimetres.—Total length 22; length of carapace 9, width 8; length of 1st leg 36, of 2nd 36, of 3rd 32, of 4th 38; protarsus of 1st 8, of 4th 9·8.

Loc. Benito River (*G. L. Bates*). An adult and an immature female.

THALASSIUS INSIGNIS, sp. n. (Plate LVII. figs. 23, 23 *a*.)

♀. *Colour.* Carapace brownish red, covered with brownish hairs speckled with white, with a black edge, within the black edge a white rim which broadens on each side of the head, the face uniformly dark, sides of thoracic portion posteriorly blackish; mandibles black with yellowish hairs; abdomen brownish above, speckled with white hairs and with white spots at the sides; lower side of abdomen, sternum, and coxæ greyish yellow. Legs variegated above; femora yellow, indistinctly variegated; patellæ yellow, blackish at the base; tibiæ yellow, black at base and apex; protarsi yellowish, also black at apex and base; tarsi yellowish; the yellowish areas of the legs covered with white hairs, the darker patches with dark hairs.

Carapace nearly circular, a little longer than wide, the width equal to the length from the posterior border to the anterior pair of eyes; length slightly less than protarsus of 1st leg, about equal to tibia of 3rd, width slightly shorter than tibia of 3rd; carapace low, higher in the cephalic region than posteriorly, not strongly elevated behind; clypeus scarcely exceeding the ocular quadrangle; ocular quadrangle longer than broad, slightly narrowed in front, the posterior median eyes much larger than the anterior median.

Legs 4, 2, 1, 3; the 1st, 2nd, and 4th subequal; patella and tibia of 1st and 2nd about equal and a little longer than those of 4th; protarsus of 4th excee ding that of 1st by about one third the length of the tarsus.

Abdomen broadest in its posterior half, gradually narrowed in front, abruptly narrowed behind.

Measurements in millimetres.—Total length 16; length of carapace 7·7, width 7·2; length of 1st leg 34, of 2nd 34·5, of 3rd 31, of 4th 35.

Loc. Benito River (*G. L. Bates*).

The characters of the foregoing species of *Thalassius* may be tabulated as follows:—

a. Carapace flatter and less elevated behind, cephalic region higher than thoracic; legs yellow, banded and spotted with black ..... *insignis*.
b. Carapace high and more convex behind, level along upperside; cephalic area not higher than thoracic.
  a^1. A broad yellow lateral stripe extending from side of head to spinners.
    a^2. Legs yellow, strongly banded with black; patella black .. *regalis*.
    b^2. Legs yellowish brown, at most spotted above with white.
      a^3. Upperside of legs ornamented with silvery white spots and bands, white spots also on upperside of abdomen above yellow band..... *leucostictus*.
      b^3. Upperside of legs and abdomen not spotted with white.
        a^4. Lateral lobes of vulva in contact, not separated mesially by a shining hairless sclerite ..... *leonensis*.
        b^4. Lateral lobes of vulva separated posteriorly in the middle line by a shining hairless sclerite ..... *batesi*.
  b^1. No definite longitudinal yellow band extending from head to spinners.
    a^5. Legs robust, thickly plumose distally; lateral lobes of vulva elongate, obliquely converging, and meeting posteriorly in a very short suture.
      a^6. Legs and upperside of abdomen strongly banded; clypeus darker than side of head ..... *formosus*.
      b^6. Legs and abdomen not banded; clypeus same colour as sides of head..... *guineensis*.
    b^5. Legs thinner, not thickly plumose; lateral lobes of vulva subquadrate, meeting or nearly meeting in a long median suture.
      a^7. Upperside of thorax and abdomen nearly uniformly golden yellow; legs chocolate-brown ..... *auratus*.
      b^7. Upperside of thorax and abdomen covered with brown and yellow hairs; legs pale, covered with greyish-white hairs ..... *inornatus*.

The following West-African species are unknown to me:—

T. spinosissimus Karsch (Zeits. gesammt. Naturwiss. lii. p. 345, 1879), described as a *Ctenus* from the Loango coast, will fall apparently under section b^1 of the above table; but seems to differ from both *T. batesi* and *T. leonensis* in having the brown field of the upperside of the abdomen laterally spotted with white, perhaps as in *T. leucostictus*. The description, however, contains no statement to the effect that the legs are ornamental as in *T. leucostictus*.

T. pictus, Simon (Ann. Soc. Ent. Belg. xlii. p. 17, 1898), from Ogowé, will according to colour characters fall under section *a* or a^6, resembling *T. insignis* in some respects; but since M. Simon makes no mention of any peculiarity in the form of the carapace, it is not permissible to suppose that his species is identical with *T. insignis*.

Genus Dolomedes Latr.

Dolomedes transfuga, sp. n. (Plate LVII. fig. 24.)

♂. *Colour* a tolerably uniform yellowish brown; carapace covered above with olive-brown hairs, with a broad marginal snow-white

band extending from middle of clypeus to side of posterior emargination. Upperside of abdomen covered with short hairs of a rusty-red hue; a snow-white lateral band set off above and below by a narrow darker stripe; legs and ventral surface not varied.

Carapace nearly circular, its width equal to the length of its upper surface from posterior median eyes to posterior emargination; its upper surface posteriorly elevated, a little higher than cephalic region; length a little less than tibia of 3rd and a little greater than the tarsus of 4th leg, a little excelling half the length of the patella and tibia of 1st and 4th. Eyes of anterior line a little recurved; laterals much smaller than centrals, their upper edges in a straight line; anterior line noticeably wider on each side than line of posterior medians, the latter much larger than anterior medians; ocular quadrangle less than height of clypeus, much wider behind than in front, its posterior width exceeding its length. Inferior border of mandible armed posteriorly with 4 teeth.

Legs long and slender, 4, 1, 2, 3 in length; patella and tibia of 1st and 2nd subequal and a little shorter than of 4th; protarsus of 4th equal to protarsus and one third of tarsus of 1st; patella armed with 3 spines, one on each side and one median apical; tarsi not scopulate, thickly setose below.

Palp extending past middle of tibia of 1st leg; tibial segment longer than patella, distally incrassate, armed externally with a crescentically upcurved pointed spine, and on the inner side with a short quadrate lightly emarginate buttress; tarsus about as long as patella and tibia, short in its basal half, subcylindrical distally.

Measurements in millimetres.—Total length 21; length of carapace 18·3, width 9; length of 1st leg 56, of 2nd 54, of 3rd 48, of 4th 60.

Loc. Benito River (*G. L. Bates*). An adult male and an immature female.

In this description some characters considered to be of generic value have been repeated to substantiate the claim of the species to be ranked in the genus *Dolomedes*. This genus is, according to Simon, replaced in Tropical Africa by the allied form *Tapinothele*, which has been recorded from Zanzibar (Hist. Nat. Araignées, i. pp. 310 & 313, 1898). But the species here named *transfuga* does not appear to differ in any important particulars from the genus *Dolomedes* as characterized by Simon, and certainly does not fall into the genus *Tapinothele*.

Family Ctenidæ.

Genus Ctenus.

Ctenus burtoni F. Cambr.

Ctenus burtoni, F. Cambr. Proc. Zool. Soc. 1898, p. 25, pl. iii. figs. 3 *a–f*.

Loc. Cameroons (*Capt. Burton*); Benito River (*G. L. Bates*).

This species is apparently nearly allied to *Phoneutria capulina* Karsch, the colour of the mandibles being apparently the same in the two species and both of them possessing the beard-like fringe of hair on the lower side of the legs, upon which Karsch lays so much stress. Fortunately the question can be without difficulty settled by a comparison between the palpus of *C. capulinus* and the figures of that of *C. burtoni* which Mr. Cambridge has published.

Ctenus occidentalis F. Cambr.

Ctenus occidentalis, F. Cambr. Proc. Zool. Soc. 1898, p. 22.

Loc. W. Africa (without further history).

Ctenus kingsleyi F. Cambr.

Ctenus kingsleyi, F. Cambr. Proc. Zool. Soc. 1898, p. 21, pl. iii. fig. 6.

Loc. Cameroons (*Miss Kingsley*).

Ctenus scopulatus, sp. n. (Plate LVII. fig. 25.)

Colour. Carapace deep mahogany, clothed with short reddish-brown hairs, hairs on the face and upper half of mandible deep carmine; mandibles shining black: legs same colour as carapace above; femora redder below, especially the base of the 1st and 2nd in front; scopulæ greyish black. Abdomen indistinctly variegated black and red above, the sides especially in front clothed with bright reddish hairs interspersed with longer hairs of a paler tint; the lower surface behind the epigastric fold entirely covered with a broad velvety-black field, narrowed and oval behind and sharply marked off at the sides by the red hairs of the lateral surface and in front by the reddish-yellow epigastric region; sternum and coxæ blackish brown.

Carapace longitudinally horizontal above, a little shorter than palp measured from base of femur, longer than patella and tibia or than tarsus and protarsus of 3rd leg, a little shorter than 4th protarsus, just about equal to protarsus and tarsus of 2nd; its width just about equal to tibia of 2nd and of 4th; ocular quadrangle longer than wide, narrowed in front, exceeding height of clypeus, which nearly equals three diameters of anterior median eyes.

Legs 4, 1, 2, 3; tibiæ of 1st and 2nd with 5 pairs of inferior spines, not spined above, of 3rd and 4th with 3 pairs and 2 anterior and 2 posterior spines and 3 superior spines; patellæ of 1st and 2nd unspined, of 3rd and 4th with 1 anterior and 1 posterior spine; tibiæ of 1st and 2nd scopulate below, of 3rd scopulate below at its distal end; protarsus of 4th scopulate except in the basal fourth of its length; protarsi of 1st and 2nd without inferior apical spine.

Vulva consisting of a reddish, heart-shaped, convex, median sclerite, with a small shining black dentiform process on each side of its posterior extremity.

Measurements in millimetres.—Total length 31; length of carapace 15, width 12; length of palp 17, of 1st leg 50, of 2nd leg 47, of 3rd leg 38, of 4th leg 51; patella and tibia of 1st leg 26, of 4th 17, protarsus of 1st 12, of 4th 16.

Loc. Benito River (*G. L. Bates*).

Rivalling the preceding species, *C. kingsleyi* and *C. occidentalis*, in size, and resembling them in the absence of the inferior apical protarsal spine of the 1st and 2nd leg; but at once recognizable from both by its coloration, especially of the lower surface of the abdomen. It further resembles *C. kingsleyi* in having the carapace shorter than the 4th protarsus and very much in the form and size of the vulva, but differs from it and approaches *C. occidentalis* in having the carapace longer than the patella and tibia of the 3rd leg.

The black patch on the lower side of the abdomen in *C. scopulatus* calls to mind the somewhat similar colouring found in *Phoneutria melanogastra* of Bösenberg and Lenz (JB. Hamburg. Mus. xii. p. 12, pl. i. fig. 14), from East Africa; but the two species are certainly quite distinct, seeing that *P. melanogastra* is less than half the size of *C. scopulatus* and has a median pale stripe on the carapace. And lastly from Simon's species *C. erythrochelis* from Landana (Bull. Soc. Zool. France, i. p. 222), which also has red hairs on the base of the mandible, *C. scopulatus* may be recognized by the absence of pale bands on the carapace and the presence of the black field on the lower side of the abdomen.

Ctenus auricularis and *C. capulinus* of Karsch, from Chinchoxo, also seem to differ in colour from *C. scopulatus*, as well as from *C. occidentalis* and *C. kingsleyi* (see Zeits. gesammt. Naturw. lii. pp. 347–348, 1879).

CTENUS RIVULATUS, sp. n. (Plate LVII. figs. 26, 26 *a*.)

♀. *Colour.* Carapace covered with blackish or olive-brown hairs, with a median pale golden stripe, and a broad irregular interrupted submarginal band extending from the sides of the clypeus to the posterior border; upperside of abdomen ornamented with a median golden-yellow or greyish band, narrow in front and indented at the sides with four pairs of large black spots; sides of abdomen blackish, mottled with yellow or grey spots; on the lower side the pale spots are arranged in definite longitudinal posteriorly converging lines; sternum, coxæ, and lower side of legs uniformly deep brown; upperside of legs varied, especially on the femora, with golden-yellow bands, the rest of the segments tinted with yellow; palpi uniformly dull brown; mandibles black in front, without bright coloured base.

Carapace slightly elevated above behind the fovea, as long as patella+tibia of 3rd leg, as tibia of 1st, and a little longer than protarsus of 1st and than tibia of 4th, about four fifths of the protarsus of the 4th; ocular quadrangle more narrowed in front than in *C. scopulatus*, its eyes relatively larger, the anterior separated by a space which about equals the radius.

Legs 4, 1, 2, 3; patella+tibia of 4th a little less than of 1st

and a little more than of 2nd; protarsi of 1st and 2nd legs without inferior apical spine; tibia of 1st lightly scopulate.

Vulva consisting of a median red sclerite, shaped like the ace of spades, as broad as long, its anterior border with a median forwardly directed prominence and convex sides; the lateral tooth less prominent than in *C. scopulatus*.

♂. Similar in colour to ♀, legs much longer (*cf.* measurements). Legs not fringed as in *C. burtoni* and *C. capulinus*; tibial spur of palpus long, viewed from above diverging externally, then turned forwards at apex; seen from the outside aspect, the upper edge is nearly straight, the lower concave, with the apex strongly bifurcate, the upper branch of the fork slightly hooked apically, the lower truncate with acute inferior angle; tarsus with only a small tuberculiform prominence at base on outer side.

Measurements in millimetres.— ♀. Total length 26; length of carapace 12, of 1st leg 44, 2nd 40, 3rd 34, 4th 47·5.

♂. Total length 20; length of carapace 11, of 1st leg 57, 2nd 50, 3rd 41, 4th 57.

Loc. Benito River (*G. L. Bates*).

Ctenus (Leptoctenus) agilior, sp. n. (Plate LV. fig. 7.)

♂. *Colour*. Carapace with pale median band constricted just behind the head, laterally infuscate, paler above the border, area around eyes black; mandibles pale, infuscate externally; palpi and legs pale, obscurely banded with greyish black; upperside of abdomen clothed with olive-yellow hairs, and diversified with red and black marking; underside flavous.

Carapace with a deep depression behind the head; head and posterior portion elevated; clypeus narrower than anterior median eyes.

Legs very long and slender; tarsal and protarsal scopulæ very scanty; tibia of 1st armed with 4 anterior and 4 posterior spines and with 6 pairs of inferior spines; protarsus of 1st with 3 pairs of inferior spines, and with 1 anterior and 3 posterior spines; patellæ spined in front and behind.

Palp with tibia longer than patella, and furnished externally with a large bifid prominence, of which the upper branch is longer and sharper than the lower; base of tarsus above furnished with a conical process; tip of tarsus prolonged and subcylindrical; tarsus not so long as patella and tibia taken together (for structural details of tarsus see Pl. LV. fig. 7).

Measurements in millimetres.—Total length 10; length of carapace 5, of palpus 9, of 1st leg 33, 2nd 29, 3rd 24, 4th 37; tibia of 1st 10, of 4th 9.

Loc. Benito River (*G. L. Bates*). A single adult ♂ example.

M. Simon has recently described two species of *Ctenus* (*Leptoctenus*) from West Africa, namely *C.* (*L.*) *lycosinus* and *C.* (*L.*) *aculeatus*, both from the Rio Pungo (Ann. Soc. Ent. France, 1897, pp. 493–4). Both are based upon females, and are not comparable with the male described above From *C.* (*L.*) *modestus* (*id. loc.*

cit. p. 492) from Zanzibar, of which the male is known, *C.* (*L.*) *agilior* certainly differs in having the tibia of the palp longer than the patella and both together longer than the tarsus, and in the form of the tibial apophysis, which is described as acute and erect.

Family Heteropodidæ.

Genus Selenops Latr.

Selenops annulatus Simon.

Selenops annulatus, Simon, Bull. Soc. Zool. Fr. i. 1879, p. 15.

Loc. Benito River (*G. L. Bates*). Recorded from Chinchoxo.

The following species from the Congo Region may be identical with the preceding:—

S. sector, Karsch, Zeits. ges. Naturw. 1879, p. 342.

S. büchneri, id. Berl. ent. Zeits. xxv. p. 94 (1881).

S. brownii, Marx, P. U. S. Nat. Mus. xvi. p. 589 (1893).

Genus Torania Simon.

Torania occidentalis (Simon).

Isopeda occidentalis, Simon, Ann. Soc. Ent. France, 1887, p. 264.

Loc. Benito River (*G. L. Bates*), Accra (*G. A. Higlett*); Afram Plain, inland of Ashanti.

Recorded by Simon from Assinie.

Torania variata, sp. n. (Plate LVIII. figs. 30–30*d*.)

♀. *Colour.* Carapace castaneous, clothed with ashy-grey hairs, with a thickened white stripe along the posterior slope, the white emphasized by a conspicuous bicrescentic black stripe in front and a pair of narrower black stripes behind; ocular area black; clypeus clothed with white hairs; mandibles nearly black, clothed with greyish hairs above; maxillæ and labium black; palpi clothed with grey hairs, mottled with black, tarsi fuscous; legs grey, mottled with black above; femora with three largish black spots above, ashy black below, those of the posterior pairs paler than the others; patellæ black beneath; tibiæ white at base and apex below, black in the middle; scopulæ blackish grey; sternum testaceous; coxæ also testaceous, those of first three legs and of the 4th slightly black in front; abdomen mottled ashy grey above, with a strong transverse sinuous black stripe in the posterior fourth of its length and irregular blackish patches at the sides and smaller spots in the middle; lower side of abdomen yellowish grey, with four narrow blackish longitudinal lines.

Carapace as broad as long, not quite so flat as in *T. occidentalis*, as long as tibia of 1st leg and as protarsus and half the tarsus of the 4th leg, a little longer than patella, tibia, and tarsus of palp. *Eyes* of posterior line recurved; distance between medians less than

between medians and laterals; eyes of anterior line with superior edges on a level, the laterals nearly twice the diameter of the medians, at all events much larger; ocular quadrangle longer than wide, parallel-sided, the anterior eyes considerably larger than the posterior and closer together.

Mandibles weakly geniculate basally; inferior edge with 4 teeth behind, 2 in front.

Legs 2, 1, 3 and 4; 2nd excelling 1st by length of its tarsus; spine-armature as in *T. occidentalis*, but with anterior spine on all the patellæ and a posterior on all the patellæ but that of 4th leg.

Vulva as in *occidentalis*, consisting of an anterior central depression followed by a pair of subcircular lobes separated in the middle line by a median groove (Plate LVIII. fig. 30*d*).

♂. Resembling ♀, but less vividly coloured and with longer legs; carapace equal to length of tibia of 3rd leg; palpal organ as in figure (Plate LVIII. figs. 30*b*–30*c*); the tibia with a pair of strong subequal external spurs.

Measurements in millimetres.— ♀. Total length 18; length of carapace 8, of 2nd leg 36, 4th leg 28.

♂. Total length 16·5; length of carapace 8, of 2nd leg 42, of 4th leg 33.

Loc. Benito River (*G. L. Bates*).

This species and the foregoing may be at once distinguished as follows:—

a. Larger, up to 30 mm. or over; anterior median eyes scarcely smaller than anterior laterals; sternum black; coxæ of 1st and 2nd legs deep blackish brown; femora with exception of the 1st, which has a black basal spot, yellowish red beneath	*occidentalis* Sim.
b. Smaller, barely 20 mm. in length; anterior median eyes much smaller than anterior laterals; sternum testaceous; coxæ of 1st and 2nd legs infuscate only in front; femora of legs, especially of 1st and 2nd pairs, ashy black beneath	*variata*, sp. n.

Genus Remmius Simon.

Remmius vultuosus Simon.

Remmius vultuosus, Simon, Ann. Soc. Ent. France, 1896, p. 484.

Loc. Benito River (*G. L. Bates*).

? Remmius vulpinus Simon.

Remmius vulpinus, Simon, Ann. Soc. Ent. France, 1896, p. 485.

Loc. Benito River (*G. L. Bates*).

A single immature female doubtfully referred to this species.

Genus Sparassus Latr.

Sparassus benitensis, sp. n. (Plate LVI. figs. 12, 12*a*, & Plate LVIII. fig. 27.)

♀. *Colour* of carapace a uniform ochre-yellow, clothed with

yellow hairs; mandibles, maxillæ, and labium mahogany-brown; sternum and legs much the same colour as the carapace; femora redder below, indistinctly spotted above; protarsi covered above with a clothing of greyish hairs, the rest of the segments scantily hairy; abdomen covered with brightish yellow hairs, marked above and at the sides with short darker stripes and with a darker median longitudinal stripe emphasized by three pairs of black spots; dark blackish brown over the spinners.

Carapace a little longer than tibia of 4th leg, equal to the length of its protarsus, a little longer than patella, tibia, and tarsus of palp, and a little shorter than protarsus and tarsus of 3rd leg; its width about equal to tibia of 4th leg, and to patella, tibia, and tarsus of palp.

Eyes of posterior line subequally spaced, space between the medians almost equal to twice their diameter; ocular quadrangle parallel-sided and about as long as wide; the anterior median eyes a little larger than the posterior median, about a diameter apart, less than a diameter from the anterior laterals, which they equal in size and with which they are in the same straight line; clypeus less than diameter of anterior median eye.

Legs long and slender; tibiæ of legs armed with 11 spines, the odd spine being in the dorsal middle line; patellæ armed with an anterior and a posterior spine; protarsi of 1st and 2nd scopulate to the base, of the 2nd less closely than of the 1st; basal portion of 3rd scarcely scopulate; 4th protarsus only scantily scopulate in its distal half.

Vulva as in figs. 12, 12*a*, Plate LVI.

Measurements in millimetres.—Total length 14; length of carapace 6, width 5·5; length of 1st leg 28, of 2nd 29·5, of 3rd 20, of 4th 23·5; patella and tibia of 1st 10·5, of 4th 8.

♂. *Colour.* Carapace yellow, clothed with ferruginous hairs and mottled with white bands and spots; legs mottled with white blotches and bands; upperside of abdomen variegated with white and olive-green hairs.

Carapace distinctly longer than broad, the length a little less than tibia of 3rd and than half patella+tibia of 1st leg. Eyes of posterior line practically straight; anterior medians about half their diameter apart and a little nearer to the laterals, which are distinctly smaller.

Legs moderately long; 2nd surpassing 1st by barely half its tarsus; 3rd slightly surpassing tibia of 2nd and middle of protarsus of 4th; 2nd a little less than six times, 4th a little less than five times, as long as carapace; tibiæ with a pair of apical inferior spines; patellæ with anterior and posterior spine.

Palp with tibia considerably longer than patella, armed with 5 long spines; the apophysis short at the base, its distal portion bent downwards nearly at right angles and forming a slender spiniform process; tarsus oval, about as long as patella and tibia.

Measurements in millimetres.—Total length 13; length of carapace 6, width 4·8; length of 1st leg 33, of 2nd 34, of 3rd 22·5, of 4th 28; patella and tibia of 1st 12·5, tibia of 3rd 6.

Loc. Benito River (*G. L. Bates*).

SPARASSUS BATESI, sp. n. (Plate LVIII. fig. 29.)

♀. *Colour.* Carapace, sternum, palpi, and legs flavous, less darkly coloured distally, with blackish-grey scopulæ on the protarsi and tarsi; tarsus of palp also with blackish-grey scopulæ; mandibles black; abdomen golden yellow, intermixed with brown, with transverse darker stripes passing outwards from the middle line; sides of abdomen golden yellow, indistinctly mottled; lower side of abdomen yellow.

Carapace high, about as long as broad; cephalic region strongly convex from side to side and from behind forwards; width of head almost equal to its length measured from the anterior end of the fovea; eyes more widely spaced than in *S. benitensis*; the ocular quadrangle distinctly narrowed in front.

Mandibles with 4 teeth behind and 2 in front.

Legs as in the preceding species, but without patellar spines and with only two pairs of spines on lower side of tibia.

Vulva as in fig. 29, Plate LVIII.

Measurements in millimetres.—Total length 14; length of carapace 6, width 5·9; width of head 4; length of 1st leg 26, of 2nd 28, of 3rd 19·5, of 4th 23.

Loc. Benito River (*G. L. Bates*).

SPARASSUS TRIFURCATUS, sp. n. (Plate LVIII. fig. 28.)

♂. *Colour.* Integument pale olive-yellow, clothed with hairs of a golden-yellow hue; mandibles pale; tarsus of palp infuscate.

Carapace high, convexly rounded, a little longer than broad, its length nearly equal to tibia of 3rd leg and to half the patella and tibia of the 1st. *Eyes* of posterior line very slightly recurved, subequal, subequally spaced, the medians a little less than two diameters apart; eyes of anterior line straight by their centres, medians larger than laterals, half a diameter apart and a little more than that from the laterals.

Legs 2, 1, 4, 3; 2nd surpassing 1st by a little more than its tarsus, 3rd barely surpassing tibia of 2nd and not reaching tip of protarsus of 4th; 2nd leg only a little more than five times as long as the carapace, the 4th rather more than four times; patellæ of 1st, 2nd, and 4th with an anterior spine; no apical spines on under side of tibiæ.

Palp with tibia a little longer than patella, both without spines; tibial apophysis consisting of 3 strong teeth, the upper the thickest, obliquely truncate apically, and ending in a sharp point, the inferior shorter and thinner than the rest; tarsus elongate oval, about as long as patella + tibia taken together.

Measurements in millimetres.—Total length 13; length of carapace

6·5, width 5·8; length of 1st leg 31·5, of 2nd 35, of 3rd 24, of 4th 28; patella + tibia of 1st leg 12, tibiæ of 3rd 6.

Loc. Cameroons.

SPARASSUS RUFILATUS, sp. n. (Plate LVI. figs. 13, 13*a*.)

♂. *Colour* much as in *S. trifurcatus*, except that the legs are more orange-red, though the bases of the femora remain pale; the upper-side of the abdomen studded with dark reddish-brown spots and the lower side behind the epigastric fold uniformly pinkish brown.

Carapace very slightly longer than wide, less than tibia of 3rd and than half the patella + tibia of 1st leg.

Eyes of posterior line slightly procurved, subequal and subequally spaced; eyes of anterior line closer together, equally spaced, distance between medians about half their radius.

Legs very long, 2nd surpassing 1st by its tarsus and one third of its protarsus; 2nd leg about seven times as long as carapace. Tibia without apical inferior spines; patellæ unspined.

Palp with tibia cylindrical, much longer than patella, and armed internally with a single long spine; patella unspined; tibial apophysis consisting of a forwardly directed spur, the apex of which is pointed and hooked; tarsus very large, its external edge concave, internal convex; palpal organ constructed as in fig. 13, Plate LVI.

Measurements in millimetres.—Total length 14; length of carapace 6·5, width 6; length of 1st leg 40, of 2nd 45·5, of 3rd 29, of 4th 33; patella + tibia of 1st 14·8, tibia of 3rd 7·8.

Loc. Cameroons.

The females of the foregoing species may be recognized as follows:—

a. Head narrower, its width only equal to the length between the anterior end of the fovea and the posterior line of eyes; eyes closer together, the ocular quadrangle scarcely narrowed in front; mandibles reddish brown; tibia with 3 pairs of inferior spines; patellæ at least on 2nd and 3rd legs spined in front and behind ..... *benitensis*, sp. n.

b. Head broader, its width almost equal to the entire length measured from the apex of the fovea; eyes more widely spaced, the ocular quadrangle distinctly narrower in front; mandibles black; tibiæ with two pairs of spines beneath; patellæ unspined ..... *batesi*, sp. n.

The males of the species here described may be determined as follows:—

a. Tibial process of palp trifurcate (tibiæ of legs without inferior apical spines; 2nd leg a good deal longer than 1st, and only a little more than five times as long as carapace; patella and tibia of palp without spines) ... *trifurcatus*, sp. n.

b. Tibial process of palp simple, undivided.

a[1]. Tibial process stout at base, its distal half slender and bent downwards almost at right angles; tibiæ of legs with two pairs of inferior spines; 2nd leg only a little longer than 1st, and less than six times as long as carapace; tibia of palp strongly spined ..... *benitensis*, sp. n

b^1. Tibial process of palp stout, straightish, hooked at apex; tibiæ of legs with 3 pairs of spines; 2nd leg considerably longer than 1st and about seven times as long as carapace; tibiæ of palp with only 1 spine... *rufilatus*, sp. n.

Sparassus (*Olios*) *alluaudi* Simon (Ann. Soc. Ent. Fr. 1887, p. 264), from Assinie, resembles *S. batesi* in certain characters, for example in having the carapace as wide as long and the mandibles black; but according to Simon the eyes of the anterior line are procurved in *S. alluaudi*, whereas they are straight in *S. batesi* and the upperside of the abdomen is ornamented with a longitudinal, lanceolate fuscous band.

PALYSTODES, gen. nov.

Carapace about one-third longer than wide, rather low, moderately convex, flat above longitudinally; the cephalic area not raised. *Eyes* of posterior line nearly equidistant, very slightly recurved, the medians larger than the laterals, which are sessile; those of anterior line also equidistant, their lower edges on a level, the medians much smaller than the laterals, their diameter less than the radius of the latter; clypeus low, less than the diameter of anterior medians; quadrangle of median eyes much longer than wide, wider behind than in front, the eyes subequal.

Mandibles armed below with 3 teeth in front and 3 behind.

Legs 1, 2, 4, 3, completely laterigrade, very long and slender.

Recognizable from *Palystes*, to which it is most nearly related, by having the carapace narrower and its upper surface flat from the eyes to the posterior end of the thoracic fovea. In *Palystes* the carapace is strongly convex longitudinally.

PALYSTODES PLUMOSUS, sp. n. (Plate LVIII. figs. 31, 31*a*.)

♂. *Colour*. Carapace castaneous, covered with a coating of brownish hairs, mottled with darker and lighter patches; mandibles deep mahogany, clothed with mottled greyish-yellow hairs; labium and maxillæ black; sternum black, striped with red bands, which cross it transversely on a level with the coxæ; coxæ covered with rich yellowish-red hairs, black in front; legs blackish, femora spotted with white below, white spotted with black above, with tufts of brownish hairs in front; patellæ white below; tibiæ with two white stripes below, one median and one apical; upperside of tarsi and protarsi brownish, mottled with tufts of hair; scopulæ of tarsi and protarsi rusty red; the colouring of the 4th leg less distinctly marked than that of the others; apex of femora, tibiæ, and protarsi, especially of 4th leg, with short tufts of hair, somewhat as in some species of *Pandercetes*; palpi black, mottled above, the hairs more uniformly flavous below; tarsus covered with ferruginous hairs, fuscous apically below. Abdomen mottled with greyish-yellow above, with tufts of brown hairs, a short anterior median black stripe, and on each side of the middle line a large semicircular black stripe, the anterior and posterior ends of which

are almost in contact in the middle line, the former just in front of the middle of the upper surface, the latter a little distance in front of the spinners; lower side of abdomen covered with a broad undivided field of deep rich, nearly blood-red hairs, a narrow arched transverse black stripe behind the epigastric fold; the epigastric region blackish, relieved, especially posteriorly, with golden-yellow hairs; sides of abdomen above the red field greyish, mottled with red anteriorly.

Carapace equal to length of 4th tibia and 3rd femur, width equal to about half the length of protarsus and tarsus of 2nd leg.

Legs—spines of 1st and 2nd femora, 3, 2, 3; of 3rd, 2, 2, 3; of 4th, 3, 2, 2; 1st and 2nd patellæ, 1, 1; of 3rd and 4th, 1 anterior; tibiæ, 2, 2, 2 below, 2 in front, 1 above, and 2 behind; protarsi, 2, 2 below, 2 behind, 3 in front; tibiæ of 1st and 2nd sinuous; femora of 1st and 4th equal; 1st leg nearly five times as long as carapace, 3rd leg about three and half times as long, 4th about four times as long.

Abdomen more than one third longer than broad, voluminous, broadest just behind the middle, then narrowed abruptly to its termination.

Vulva consisting of a transversely oval pit, followed by a pair of skeletal pieces separated by a narrow median sclerite.

Measurements in millimetres.—Total length 25; length of carapace 11, width 8; length of 1st leg 56, of 2nd 52, of 3rd 39, of 4th 48 (all measured from base of femur); patella and tibia of 1st 21, of 4th 16; protarsus of 1st 14, of 4th 12.

Loc. Benito River (*G. L. Bates*).

Family THOMISIDÆ.

Genus PHRYNARACHNE Thorell.

PHRYNARACHNE RUGOSA (Latreille).

Thomisus rugosus, Latreille, Nouv. Dict. d'Hist. nat. xxxiv. p. 62.

Thomisus foka, Vinson, Aranéides Madagascar, &c. p. 69, pl. xiv. fig. 4 (1863).

Loc. Benito River (*G. L. Bates*).

The specimen of *Phrynarachne* obtained by Mr. Bates seems identical with an example in the British Museum from Madagascar.

PHRYNARACHNE MARMORATA, sp. n. (Plate LVI. fig. 14.)

♀. *Colour.* Carapace with a large jet-black patch on each side of the thoracic portion; the margins yellowish brown and the middle line clearer yellow; head infuscate, the ocular tubercles amber-yellow, a yellowish-white band passing from the median eyes to the lateral angles of the clypeus; upper portion of mandible yellowish white, lower portion infuscate; basal half of palpi yellowish white, tibia and tarsus infuscate; legs of 1st and 2nd

pairs with coxæ, trochanters and femora, patellæ, and basal half of tibiæ yellow, clouded or marbled with black; distal half of tibiæ and protarsi black, slightly variegated with yellow, tarsi yellow; 3rd and 4th legs black, with tarsus and basal half of femur yellow, and the rest of the segments varied with yellow marks; sternum yellow, clouded with black; upperside of abdomen black in its anterior half, with a median yellow stripe, the posterior half reddish brown in the middle, jet-black on the posterior angles; a large yellowish-green triangular patch spreading in from the sides in front of the posterior angles; sides of abdomen whitish yellow; ventral surface yellowish brown, varied with black markings.

Carapace a little excelling tibia of 1st leg in length; flat above, not elevated posteriorly as in *rugosa*, the tubercles high and conical; eyes of anterior line a little more recurved; median ocular quadrangle more narrowed anteriorly than in that species.

Legs longer than in *rugosa*; the tibia of 1st and 2nd pairs more strongly bowed; tubercles on femora larger; spines on protarsi more numerous and longer, those on upperside of the segment forming a distinct long pectinated series, which distally largely overlaps the base of the tarsus.

Abdomen widest along its posterior border, which is truncate; width across the middle less than the length; width across posterior angles exceeding the length; tubercles large and conical, not low as in *rugosa*.

Vulva consisting of a median anteriorly narrowed piriform lobe, lodged in a depression bounded by a semicircular border.

Measurements in millimetres.—Total length 9; length of carapace 4·2, width 3·8; length of abdomen 5, width posteriorly 6.

Loc. Benito River (*G. L. Bates*).

Easily recognizable from *P. rugosa* by the variegated colouring, stronger tuberculation, longer anterior legs, &c.

Genus Thomisus Latr.

Thomisus tripunctatus Lucas.

Thomisus tripunctatus, Lucas, in Thomson's Arch. Ent. ii. p. 400, pl. xii. fig. 3 (1863).

Loc. Sierra Leone (*Surg.-Capt. Clements*), and subadult specimens probably referable to this species from the Benito River (*G. L. Bates*).

Genus Platythomisus Dol.

Platythomisus nigriceps, sp. n. (Plate LVIII. fig. 32.)

♀. *Colour.* Carapace coal-black, with narrow yellow margin at the sides and posteriorly; mandibles, maxillæ, labium, and sternum black; palpi yellow, infuscate quite at tip of tarsus; coxæ and trochanters of all the legs yellow; femora of 3rd and 4th pairs also yellow except for a black apical ring; femora of 1st and 2nd pairs deeply infuscate, yellow quite at base; remaining segments of all

the legs jet-black. Abdomen variegated; upperside yellow, with three pairs of large black patches, the anterior pair united by a narrow bridge, the third pair the smallest and triangular; these are followed by a transversely crescentic black stripe, the concavity of which is posterior; behind this are two median black spots, one behind the other; on each side of the abdomen is a broad black stripe, which unites with its fellow of the opposite side above the pedicel in front and stops short some little distance above the spinners behind; spinners black, with a dorsally incomplete black ring around them; the ring is connected in the middle line below with a pair of broad black stripes, which unite posteriorly, are separated by a narrow median yellow stripe, and extend from the epigastric fold to the posterior third of the lower side of the abdomen; region of vulva and lung-books brown, darker mesially.

Carapace as wide as long, strongly convex; cephalic area sloped downwards and forwards; its total length about equal to tibia of 1st leg and to patella and tibia of 4th. *Eyes* of anterior and posterior lines distinctly recurved when viewed from above; distance between anterior and posterior medians equal to that between anterior and posterior laterals; distance between posterior medians greater than that between posterior median and lateral on each side; distance between anterior medians less than between median and lateral on each side; ocular quadrangle much wider than long, much narrowed in front, the distance between the posterior medians at least one third greater than that between the anterior medians.

Legs long; 1st leg about four times as long as carapace; tarsi of 1st and 2nd with thick apical scopula; protarsi and tarsi of 3rd and 4th also scopulate; tibiæ and protarsi of 1st and 2nd not visibly spined beneath.

Abdomen voluminous, not quite twice as long as wide, broadest just behind the middle, rounded in front, narrowed and somewhat pointed behind.

Measurements in millimetres.—Total length 17; length of carapace 5·5, of 1st leg 22·5, 2nd leg 21, 3rd leg 12, 4th leg 14·5; length of abdomen 12, width 8·3.

Loc. Benito River (*G. L. Bates*). A single ♀ example.

PLATYTHOMISUS INSIGNIS, sp. n. (Plate LVIII. fig. 33.)

♀. *Colour.* Carapace orange-yellow, with a narrow black rim, incomplete behind but complete along the clypeus; ocular area involved in a broadish transverse black stripe; mandibles yellow, broadly black externally and apically, maxillæ and labium yellow, the latter infuscate marginally, the former internally at the apex; sternum yellow, with anteriorly and posteriorly incomplete median black line; palpi yellow, tip of tarsus blackish; legs coloured as in *nigriceps*, but with more black at the distal half of the femora. Abdomen mostly yellow, the upperside with three pairs of black patches, the posterior pair small and followed by a small median black spot; anterior surface of abdomen with a broad transverse

black stripe, which on the sides of the abdomen breaks up into a fan-like arrangement of narrow black longitudinal stripes extending as far as the spinners; spinners black; the lower surface of abdomen testaceous yellow.

Structurally allied to *P. nigriceps*, but the ocular quadrangle wider as compared with its length; legs distinctly shorter, the 1st less than four times as long as the carapace; length of carapace much greater than that of tibia of 1st leg and distinctly greater than patella and tibia of 4th; tibiæ and protarsi of 1st and 2nd legs distinctly spined below; abdomen about one third longer than wide, a long oval, not noticeably wider behind the middle.

Measurements in millimetres.—Total length 21; length of carapace 7, of abdomen 14·5, width of abdomen 9·5; length of 1st leg 25, of 2nd 25, of 3rd 16, of 4th 17.

Loc. Benito River (*G. L. Bates*).

The previously described African species of this genus are:—

P. heraldicus, Karsch, Zeits. ges. Naturwiss. li. p. 315, pl. viii. fig. 4 (1878); Simon, Hist. Nat. Araignées, i. p. 1016, fig. 1077 (1895). From Zanzibar and Lake Tanganyika.

[I have seen no specimens of this species, but it certainly differs from all those enumerated in the table below in having the upper-side of the abdomen black with yellow spots, instead of yellow with black spots.]

P. sex-maculatus, Simon, in Donaldson Smith's 'Through Unknown African Countries,' p. 388 (1897). From Somaliland.

P. pantherinus, Poc., Ann. & Mag. Nat. Hist. (7) ii. p. 445, pl. xiii. fig. 7 (1898). From Nyasaland.

The four Tropical African species of this handsome genus, represented in the British Museum by the typical examples, may be distinguished as follows:—

a. Carapace, mandibles, labium, maxillæ, and sternum jet-black; lower side of abdomen with a pair of broad black narrowly separated bands, which unite posteriorly ..... *nigriceps*, sp. n.

b. Carapace principally yellow or red, margined or spotted with black, and black in the ocular region; mandibles, maxillæ, labium, and sternum principally or wholly yellow; abdomen without black bands on the middle of its ventral surface.

a[1]. Carapace red or yellow, with a black margin and transverse black frontal stripe; mandibles externally black; black abdominal spots large.

a[2]. Femora of 1st and 2nd legs deep blackish green; the black margin of carapace extending right round beneath the clypeus but not joining the ocular stripe; sides of abdomen ornamented with narrow branching stripes arranged longitudinally; no black rings round the spinners below..... *insignis*, sp. n.

b[2]. Femora of 1st and 2nd legs clear yellow; black margin on carapace not extending on to face,

stopping short on a level with the 1st leg; frontal stripe involving lateral angles of carapace and sides of abdomen occupied by a continuous black stripe, extending to the spinners; spinners surrounded by ring of black below ... *sex-maculatus* Sim.

b^1. Carapace yellow, not margined with black, spotted with black; mandibles not black externally; black abdominal spots small ..... *pantherinus* Poc.

EXPLANATION OF THE PLATES.

Plate LV.

Fig. 1. *Aranæthra butleri* (p. 860). × 4.
2. *Æthrodes mammosa* (p. 861). × 3 (nearly).
3. *Araneus tyloscapus* (p. 851). × 2.
3*a*. „ „ vulva from below.
3*b*. „ „ vulva from behind.
4. *Cyrtophora margaritata* (p. 854). × 2.
4*a*. „ „ vulva.
5. *Cærostris argostictus* (p. 855). × 2.
5*a*. „ „ vulva.
5*b*. „ „ front leg from below.
6. *Phalæa ferox* (p. 863), vulva.
6*a*. „ „ diagram of arrangement of eyes.
7. *Ctenus* (*Leptoctenus*) *agilior* (p. 873), tibial spurs of palp (spurs shaded).

Plate LVI.

Fig. 8. *Araneus hæmatocnemis* (p. 850). × 1¼.
8*a*. „ „ var.
8*b*. „ „ var.
8*c*. „ „ vulva, lateral view.
9. *Araneus rhinurus* (p. 852). × 2.
9*a*. „ „ vulva, lateral view.
10. *Gasteracantha batesi* (p. 858). × 2.
11. *Phoneyusa bidentata* (p. 843), palpal organ.
12 & 12*a*. *Sparassus benitensis* (p. 875), two forms of vulva.
13. *Sparassus rufilatus* (p. 878), palpal organ from below.
13*a*. „ „ tibial spur of palp.
14. *Phrynarachne marmorata* (p. 880). × 3.

Plate LVII.

Fig. 15. *Cærostris turriger* (p. 857), side view. × 1½.
15*a*. „ „ vulva.
16. „ *albescens* (p. 856), vulva.
17. *Peucetia longipes* (p. 861), vulva.
18. *Thalassius guineensis* (p. 864), vulva.
19. „ *formosus* (p. 865), lateral view of carapace.
20. „ *auratus* (p. 866), vulva.
21. „ *leonensis* (p. 867), vulva.
22. „ *regalis* (p. 868), vulva.
23. „ *insignis* (p. 868), vulva.
23*a*. „ „ lateral view of carapace.
24. *Dolomedes transfuga* (p. 869), tibial spur of ♂.
25. *Ctenus scopulatus* (p. 871), vulva.
26. „ *rivulatus* (p. 872), tibial spur of ♂.
26*a*. „ „ central portion of palpal organ.

BRITISH
25 AP 1900
MUSEUM

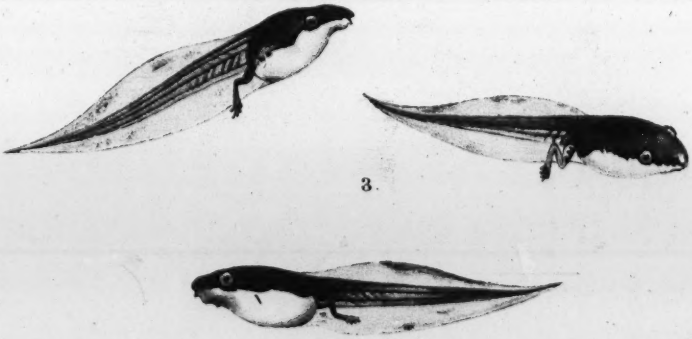
1.

1a.

2a.

2.

3a.



3.

S.S.Flower del. P.J.Smit lith.

Mintern Bros Chromo.

TADPOLES.

1. RANA MACRODON. 2. RANA TIGRINA.
3. RHACOPHORUS LEUCOMYSTAX.

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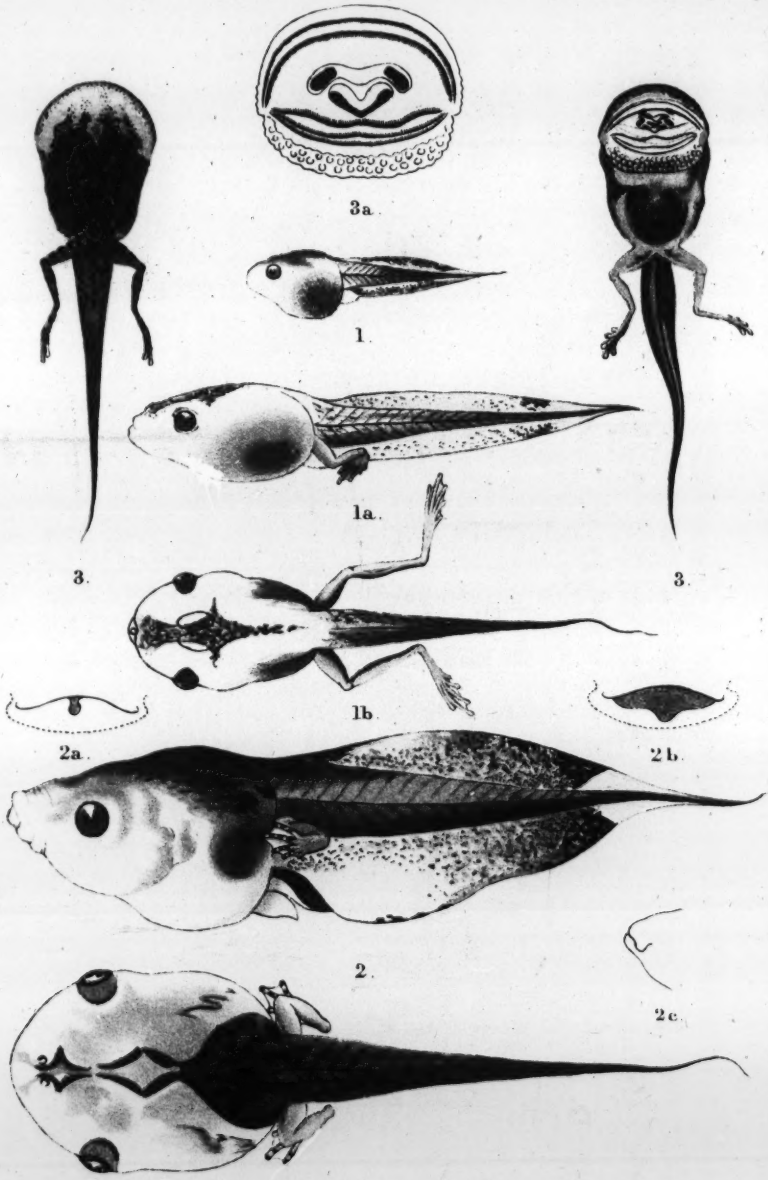

S.S.Flower del. P.J.Smit lith. Mintern Bros. Chromo.

TADPOLES.

1.MICROHYLA ORNATA. 2.MICROHYLA(?)SP.?

3.BUFO PENANGENSIS.

PLATE LVIII.

Fig. 27. *Sparassus benitensis* (p. 875), tibial spur of ♂.
28. „ *trifurcatus* (p. 877), tibial spur of ♂.
29. „ *batesi* (p. 877), vulva.
30. *Torania variata* (p. 874), tibial spurs (upper or right, lower or left).
30*a*. „ „ lower tibial spur from below.
30*b*. „ „ palpal organ from below.
30*c*. „ „ membrane process of palpal organ.
30*d*. „ „ vulva.
31. *Palystodes plumosus* (p. 879), ♀. × 1½.
31*a*. „ „ vulva.
32. *Platythomisus nigriceps* (p. 881), ♀. × 1½.
33. „ *insignis* (p. 882), ♀. ×½.

3. Notes on a Second Collection of Batrachians made in the Malay Peninsula and Siam, from November 1896 to September 1898, with a List of the Species recorded from those Countries.

By STANLEY SMYTH FLOWER, 5th Fusiliers, F.Z.S.

[Received May 29, 1899.]

(Plates LIX. & LX.)

To the List of 34 Batrachians from the Malay Peninsula published in the Society's 'Proceedings,' 1896 (pp. 897–914), eight species can now be added, viz.:—*Rana kuhlii* Schleg., *R. macrodactyla* (Günth.), *R. larutensis* Blgr., *Microhyla ornata* (D. & B.), *M. leucostigma* Blgr., *Bufo divergens* Peters, and two large species of *Rhacophorus*; making a total of 42 species.

In the British Museum Catalogues of Batrachians 11 species have been recorded from Siam. Nine species can now be added, viz.:—*Rana macrodactyla* (Günth.), *R. nigrovittata* (Blyth), *Calophrynus pleurostigma* Tschudi, *Microhyla ornata* (D. & B.), *M. inornata* Blgr., *M. pulchra* (Hallow.), *M. achatina* (Boie), *M. berdmorii* (Blyth), and *Bufo macrotis* Blgr.; making a total of 20 species.

This list must represent, however, but a small proportion of the forms which will eventually be found to inhabit this part of the world.

In this paper a little-known frog, *Rana plicatella*, first made known by Stoliczka, is redescribed, and the tadpoles of the following species are described, I believe, for the first time:—*Rana macrodon*, *R. tigrina*, *Microhyla ornata*, *Bufo penangensis*. Besides these there is a very remarkable tadpole from Penang, the adult form of which, so far as I have been able to discover, is undescribed; it is hoped this notice of it may attract other collectors to observe it and to find out to what species it belongs.

I have to acknowledge my sense of obligation to Mr. G. A. Boulenger, F.R.S., for his invaluable advice and very kind help in answering many questions for me in letters during the last three years.

Order ECAUDATA.

Family RANIDÆ.

1. OXYGLOSSUS LIMA (Gravenh.).

Oxyglossus lima, Blgr. Cat. Batr. Sal. p. 5.

"Kato' limpong" of the Malays of Kedah.

Localities. In the P. Z. S. 1896, p. 897, I wrote:—"This species is said to occur in the Malay Peninsula, but I have not been able to find it recorded south of Tenasserim, though it occurs again in Java"; but since then, in June 1898, I found it numerous near Alor Star and at Jenan, in the State of Kedah, Malay Peninsula. M. Mouhot obtained specimens in Siam and Cambodia. I obtained specimens at the following places in Siam:—one Bangkok (July), many Sapatoom (August), many Ayuthia (December), one a few miles north of Ayuthia (February), many Pakpreo (June), and one Bawtong Kabin (March).

Habits. This is a thoroughly aquatic frog, to be found in small ponds.

Colour (in life). Above olive-brown (Kabin specimen dark, Pakpreo ones light), lighter and greener on limbs, with or without a pale yellow vertebral line; beneath yellow, more or less handsomely marked with dark olive-brown, including a narrow line along middle of abdomen; back of thigh conspicuously marked with two yellow lines or a broad black one. Iris: narrow gold line surrounding the black diamond-shaped pupil, remainder brown.

A particularly handsome individual from Bangkok was coloured in life:—Above olive-brown mottled with dark brown, a broad black-edged vertebral line grass-green anteriorly, shading to olive-green posteriorly; beneath pale yellow, a pair of very distinct black lines from the chin to the breast (the tubercles on these lines form small yellow spots), a black line beneath each arm, three longitudinal irregular dark brown lines on each side of the body, an L-shaped black line on each side of the base of the thighs, a very broad black line along the hinder side of the thigh, above it being two narrow parallel ones, the interspaces forming pale yellow lines.

The eyes of *O. lima* in life are very prominent and look upwards and outwards.

Size. The largest specimens measures snout to vent 33 mm.

Distribution. Lower Bengal, Burma, Southern China, Siam, Cambodia, Cochin China, Malay Peninsula, Java.

2. OXYGLOSSUS LÆVIS Günther.

Oxyglossus lævis, Blgr. Cat. Batr. Sal. p. 6; Blgr. P. Z. S. 1897, p. 228 (tadpole).

In the Museum at Taiping there are specimens from swamps

near Taiping, Perak; and Dr. Hanitsch (Rep. Raffles Libr. & Mus. 1898) records the species from swamps near Ipoh, Perak (March).

Distribution. Burma, Malay Peninsula, Sumatra, Sipora (Mentawei Islands), Borneo, Flores, Celebes, Philippines.

3. Oxyglossus martensii (Peters).

Phrynoglossus martensii, Peters, Mon. Berl. Ac. 1867, p. 29.
Oxyglossus martensii, Blgr. Cat. Batr. Sal. p. 6.

Localities. I obtained specimens at the following places in Siam :—one Bawtong Kabin (March), one Chantaboon (January), many in the Dong Phya Fai (November), elevation 900 feet, and a few near Ayuthia (February and June).

Habits. This species does not seem so thoroughly aquatic as *O. lima*; out of seventeen individuals I caught at the above places only two were actually in ponds, though all were near water.

Colour (in life). Sometimes a narrow yellow vertebral line is present. Behind the eyes a broad transverse patch of red-brown and orange is conspicuous. Iris yellow, closely and finely speckled with brown. The diamond-shaped pupil is dark red in colour.

Size. The largest specimen measures snout to vent 27 mm.

Distribution. Siam.

4. Rana cyanophlyctis Schneider.

Rana leschenaultii, Cantor, p. 138.
Rana cyanophlyctis, Blgr. Cat. Batr. Sal. p. 17; Anderson, P. Z. S. 1895, p. 660, pl. xxxvii. fig. 2 (tadpole).

This frog does not seem to have been observed in the Malay Peninsula since Cantor's time.

Habits. South Arabia, Baluchistan, Cashmere, Himalayas (up to 6000 ft.), India, Ceylon, Malay Peninsula.

5. Rana kuhlii Schleg.

Rana kuhlii, Blgr. Cat. Batr. Sal. p. 20; P. Z. S. 1899, p. 166.

Localities. This frog, not previously recorded from the Malay Peninsula, was found by Dr. Hanitsch in Perak in 1897. In April 1898 I obtained four specimens in the same locality, Maxwell's Hill (Larut Hills, Perak), at an elevation of 3300 feet.

Colour (in life). Above olive-green, with irregular, indistinct small black spots; a distinct black transverse line between the eyes, the skin immediately in front and behind this being yellowish olive. Limbs yellowish olive, extensively spotted with dark olive-brown, which spots have a tendency to form cross-bars. Chin and sides of head, neck, body, and limbs chrome-yellow. Lips extensively mottled with dark olive-brown. Lower surfaces buff. Tympanic fold black. Web of hind feet pale yellowish olive. Iris: a narrow rim of gold round black pupil, remainder bronze with a black cross (much as in *Rana macrodon*).

Size. The largest ♂ measured: snout to vent 90 mm.; width of

head 38 mm.; arm 46 mm.; leg 115 mm. The largest ♀ measured: snout to vent 70 mm.; width of head 27 mm.

Distribution. Southern China, Burma, Malay Peninsula, Sipora (Mentawei Islands), Java, Borneo, Celebes.

6. RANA LATICEPS Blgr.

Rana laticeps, Blgr. Cat. Batr. Sal. p. 20, pl. i. fig. 1; S. Flower, P. Z. S. 1896, p. 897.

Dr. Hanitsch (Rep. Raffles Libr. & Mus. 1898) records obtaining *Rana laticeps* from Gunong Kledang, Ipoh, Perak, in March 1898, at an elevation of 2000 feet.

Distribution. Khassya, Bengal, Malay Peninsula.

7. RANA MACRODON Kuhl. (Plate LIX. figs. 1, 1*a*.)

Rana macrodon, Blgr. Cat. Batr. Sal. p. 24.

In the P. Z. S. 1896, p. 898, I pointed out that there appear to be two forms of this species in the Malay Peninsula; since then I have seen a large number of these frogs, all of which were referable to one or other of the varieties, but I found large specimens of the Penang variety may approach the Singapore variety in colour (having the upper parts reddish or brownish yellow), and in the distance of the nostrils apart being less than the interorbital space.

The stomachs of these big frogs generally contain a good deal of foreign matter, bits of leaves, small twigs, sand, fine granite, gravel, and angular pebbles as much as 10·5 mm. in diameter. Their food consists of snails, crabs (Thelphusidæ), caterpillars, beetles, crickets, ants, &c., and twice I have found the remains of scorpions (*Hormurus* sp. incert.) in their stomachs. Sometimes there are a number of parasitic worms between the kidneys and the back.

The fang-like bony prominences in the lower jaw are sometimes very sharp and nearly 5 mm. in length.

Localities. Penang Hills, 1900 to 2200 feet (November 1896, March and April 1898); Larut Hills, Perak, 3200 to 3400 feet (April 1898): in both of these localities the Penang variety is numerous about water (mountain streams and pools) and grows to a large size. I also got two very typical specimens of this variety near the foot of Gunong Pulai, Johore (September 1897), from which State this species had not previously been recorded; and it is interesting to thus find the Penang variety at a low elevation (about 200 feet) and so near the island of Singapore. So far I have not come across the Singapore variety on the mainland or at Penang.

Colour (in life). One specimen from Penang was unusually coloured, the upper parts being rich bronze-red and the limbs handsomely marked with yellow and dark brown; below (as usual) the chin was white and the remainder pale orange. Iris (noted from many specimens): a narrow ring of bright gold round the

black pupil, remainder pale golden finely speckled with black, and a broad horizontal line and a narrow perpendicular line forming a black cross on the eye.

Size. ♂. Snout to vent 120 mm.; width of head 48 mm.; leg 183 mm.

♀. Snout to vent 88 mm.; width of head 30 mm.

These measurements are from Perak specimens, Penang ones attain an equal size.

Singapore specimens reach snout to vent 165 mm.; width of head 76 mm. (P. Z. S. 1896, p. 901).

Distribution. Upper Burma, Tenasserim, Malay Peninsula, Sipora (Mentawei Islands), Java, Lombok, Flores, Natunas, Borneo, Philippines.

Tadpole.

In March 1898 I found tadpoles of this species in the clear, swift hill-streams of Penang, about 1900 feet above sea-level; they frequented the edges of the stiller pools. They are typical *Rana* tadpoles in habits and appearance; the mouth, I find on comparing my drawing with the figure by Boulenger (P. Z. S. 1891, pl. xlv. fig. 1 *a*), seems similar to that of *R. esculenta*.

Description of the Tadpole.

Length of body about once and a half its width, about half the length of the tail. Nostrils about halfway between the eyes and the end of the snout. Eyes on the upper surface of the body, nearer the end of the snout than the spiraculum, the distance between the eyes once and a half to twice as great as that between the nostrils, and slightly greater than the width of the mouth. Spiraculum on the left side, pointing backwards and upwards, nearer the anus than the end of the snout, visible from above and from below. Anus opening on the right side, close to the lower edge of the subcaudal crest. Tail about four times as long as deep, acutely pointed; upper crest convex, slightly deeper than lower, not extending to base of tail; the depth of the muscular portion of the tail, at its base, about $\frac{7}{10}$ of the greatest total depth.

Mouth. Beak broadly edged with black. Sides and lower edge of the lip bordered with papillæ; upper lip with a long series of teeth, followed on each side by a short series of very fine teeth. Lower lip with three series of teeth: 1st very short, weak and uninterrupted; 2nd also uninterrupted; 3rd longer, narrowly interrupted and stronger than the two outer rows.

Colour (in life). Above light reddish brown, of exactly the same colour as the sand on the bed of the streams they inhabit, mottled in places with darker brown; a dark brown line through the eye, sometimes other dark lines radiating from the eye. Crests and posterior portion of muscular portion of tail colourless, with

irregular dark brown vertical bars. Belly buff and transparent, showing the coil of the intestines. Iris golden, with black cross marks.

Size. Largest specimen measured in total length 34·25 mm.; length of body 11·25 mm.; width of body 7·75 mm.; length of tail 23 mm.; depth of tail 5·5 mm.

The recently transformed young measure from 9·5 to 11 mm. from snout to vent. The smallest frog which had the yellow vertebral line developed measured 13 mm. from snout to vent.

8. RANA PLICATELLA Stol.

Rana plicatella, Stol. J. A. S. B. 1873, p. 116, pl. xi. fig. 1; Blgr. Cat. Batr. Sal. p. 26.

Rana plicatella was described by Stoliczka from a single specimen (apparently), which had been at least two years in spirits; its locality was either Penang or Province Wellesley: unfortunately he does not mention either the sex or size of the type specimen. A frog caught by me in Penang I refer to this species, as it entirely agrees with his description and figure, except in the following points:—1st, a larger head; 2nd, the presence of a knob-shaped prominence on the occiput; 3rd, the upper surface of the body has about 12 longitudinal folds instead of 8; 4th, differences of colour, mostly attributable to Stoliczka's being a spirit-specimen, except that mine has 5 transverse dark bands on the femur instead of 6, the "horseshoe-shaped yellow mark, open below, round the anus" is absent and a pale vertebral line is present. The 3rd and 4th points may well be individual variations, while the 1st and 2nd may be secondary sexual characteristics, my specimen being an adult male.

This frog resembles *Rana laticeps* Blgr., known from India and Malacca, and *Rana doriæ* Blgr., from Burma, in many respects; but differs from the former in, 1st, the distinct and larger tympanum; 2nd, the less broadly webbed toes: and from both in, 1st, the distinct longitudinal glandular folds on the back; 2nd, the prominence on the occiput.

Description. Vomerine teeth on two straight ridges, commencing on a line with hinder edge of choanæ and running obliquely back from them, converging behind so as to meet, if prolonged, in an angle rather greater than a right angle. Lower jaw with two fang-like bony prominences in front. Head very large; snout bluntly pointed; canthus rostralis distinct, rounded; loreal region slightly concave; occiput swollen at the sides, interorbital region convex, the swelling produced posteriorly and ending in a knob-shaped prominence 1·5 mm. in height; in life this feature is very prominent and at once attracts the attention. Nostrils lateral, somewhat directed upwards, rather nearer the end of the snout than the eye, their distance apart is slightly greater than the inter orbital space. The breadth across the gape is much greater than the distance from angle of mouth to end of snout. Eye prominent. The interorbital space is much greater than the width of the upper

eyelid. Tympanum distinct, slightly larger than the eye. A prominent tympanic fold.

Fingers moderate, 1st slightly longer than 2nd; toes about three-quarter webbed, the web reaching on the 4th toe "to scarcely beyond the base of the third ultimate joint," on the other toes to the base of the tips, it is deeply emarginate. Tips of fingers and toes dilated into small but distinct disks. Tarsal fold very slight. Subarticular tubercles of toes well developed. Inner metatarsal tubercle elongate, prominent; practically no outer tubercle, a mere white spot (this can be distinguished in Stoliczka's figure, dorsal aspect, on the right foot). The hind limb being carried forward along the body, the tibio-tarsal articulation reaches to the nostril.

Head smooth above, hinder half of the eyelid tuberculated: skin of back with long longitudinal folds, with numerous small tubercles between them; loreal region, chin, angles of jaws, parts of forearm, and sides of body scattered with small rounded tubercles; anal region densely studded with small tubercles; back of tibiæ scattered with small tubercles, which are pointed and prominent in life; back of thighs, feet and lower surfaces of throat, body and limbs smooth. Testicles white, 2·3 mm. in length.

Size. Length, snout to vent 39 mm.; arm 24; leg 68; femur 17·5; tibia 21·5; foot 29; width of head 19; diameter of eye 4·25; diameter of tympanum 4·5; length of inner metatarsal tubercle 3.

Colour (in life). Above bronze (changing from bright yellowish red to dull brown shades), with a bright yellow narrow vertebral line, a black chevron (pointing backwards) between the eyes; the tympanic fold and some of the longitudinal folds are edged with black. Limbs with dark brown cross-bars. Belly very bright sulphur-yellow; underneath of chin, throat, and limbs yellowish bronze. (In spirit the bronze colour of the upper surfaces turned to olive-brown.)

Eye. Pupil black (dark red in some lights), horizontal diamond-shaped. Iris: a very narrow ring of red round pupil, remainder golden, closely speckled with dark bronze, a narrow black vertical line across iris and also a broad ill-defined black horizontal one.

One specimen, ♂, found in the jungle on Penang Hill, at an elevation of about 2400 feet, 19th March, 1898. It took wonderful long hops.

Distribution. Malay Peninsula (Penang).

9. RANA TIGRINA Daud. (Plate LIX. figs. 2, 2*a*.)

Rana tigrina, Blgr. Cat. Batr. Sal. p. 26; S. Flower, P. Z. S. 1896, p. 901.

Siamese. "Kop"; term also applied to other species of frogs.

I found this species common on the Bangpakong river (from Tahkamen to Kabin) in March and April 1897, where it was to be found among the sedges by the river's bank; its croak (a loud "opp, opp, opp," repeated 8 or 9 times), which sometimes was

heard in the middle of the day, betraying its presence. During the dry season I have not seen this frog at Bangkok, but from the middle of May to August they are very plentiful in suitable ponds and are to be bought in the market, as *R. tigrina* is eaten by the Siamese; I have heard Malays speak of the Siamese by the name "Frog-eaters," in consequence of this. Small Siamese boys may be seen fishing for these frogs with a short rod and a very fine line with a small hook with a white bait; this is danced and dangled over the surface of the water near the edge of a pond as if it were a fly hovering about; when a frog springs at this the angler has to "strike" very quickly, to catch the hook in the frog's mouth to draw it out of the water. I also found this species at Ayuthia in June.

Breeding-season. A pair were observed *in copulâ* in Bangkok in May, the male was considerably smaller than the female; during the latter half of July females were to be found with the ovaries distended with spawn, ready for expulsion. But well-grown tadpoles were found as early as the first week in June, in Ayuthia, and on the 28th July in Bangkok, when young frogs were leaving the water. Thus the breeding-season must extend over some months.

Colour (in life). Description drawn up from *adult* specimens of both sexes caught in Bangkok in May:—

Above olive-brown or pale olive-green, with very dark greenish-brown or black spots on the head, sides, and limbs; the back either spotless or with large dark spots; on the legs the spots may become broad dark transverse bars; no vertebral line. Below, body and limbs immaculate silvery white, between which and the green upper surface there is an irregular space of lemon-yellow with greenish-brown spots. The lips, chin, and underneath of head are lemon-yellow, with more or less distinct dark spots; sometimes there is a median dark line from the symphysial angle to the breast. The vocal sacs of the male are dark grey, shaded with pink. Iris dark brown, with narrow golden ring round the black pupil.

Half-grown specimens are often prettier coloured than the adults, being rich green above and pure white below, with many black markings.

Size. An adult ♀ from Bangkok measured snout to vent 142 mm.; another individual (sex not recorded) 153 mm.

Distribution. Nepal, Sikhim, India, Ceylon, Burma, China, Formosa, Siam, Malay Peninsula, Java, Borneo, Celebes, Philippines, Lombok, Ombaai, Sumba.

Description of the Tadpole.

Drawn up from specimens obtained in June 1897 at Ayuthia, Siam.

Length of body once and a half its width, rather more than half length of tail. Nostrils a little nearer to the eyes than to the end of the snout. Eyes on the upper surface of the body, nearer the

end of the snout than the spiraculum, the distance between the eyes twice the distance between the nostrils, and about equal to the width of the mouth. Spiraculum on the left side, directed backwards and upwards, a little nearer the anus than the end of the snout, visible from above and from below. Anus opening on the right side.

Tail from 3½ to 4 times as long as deep; acutely pointed; upper crest convex, a little deeper than the lower, not extending on to the back; depth of the muscular portion at its base about half the greatest total depth.

Mouth. The large powerful beak is entirely black; the upper mandible terminates in front in a long sharp tooth-like prominence; the lower mandible is bicuspid, each "tooth" being long and sharp. The lips are bordered with very short fleshy papillæ: inside the upper lip are five series of fine, black teeth; the 1st series is uninterrupted, the second slightly interrupted by the individual teeth being "grouped with intervals" about the centre of the line; the remaining series are broadly interrupted, the 5th being very short and difficult to distinguish: the lower lip has also five series of teeth; the 1st is short and uninterrupted, the second long and uninterrupted, the remainder broadly interrupted and very short.

Colour (in life). Above yellowish brown, mottled with darker brown, a very distinct dark brown crescent-shaped mark above each nostril. Below white, purplish grey about the chin and throat. Tail yellow, mottled with brown, an horizontal dark line along the median line of the basal third of the muscular portion. Iris golden.

Size. Total length 52 mm.; length of body 18·5; width of body 12·5; length of tail 33·5; depth of tail 9.

Habits. Those of ordinary *Rana* tadpoles.

10. RANA LIMNOCHARIS Boie.

Rana gracilis, Blgr. Cat. Batr. Sal. p. 28.

Localities & Habits. This species is very numerous in Bangkok, where I have observed it in the months of Jan., Feb., Mar., June, July, Aug., Oct., Nov., and Dec. Small specimens abound in the evening, hopping about the grass, they are very active. In the hot weather, in spite of the burnt up condition of the ground and grass, these frogs still appear at night, and, when one tries to catch them, take refuge down the sun-cracks in the parched earth. Specimens over 50 mm. snout to vent are of comparative rare occurrence.

I have also found this species common along the Bangpakong river, at Chantaboon, Paknam Menam, in fields beyond Sapatoom, Ayuthia, Pakpreo, Dong Phya Fai (up to 900 feet elevation), in Siam; at Taiping, Kuala Kangsar, and Chumar in Perak, and at Alor Star and Jenan in Kedah.

In a former paper (P. Z. S. 1896, p. 902) I wrote of this species

at Singapore:—"It does not attempt to escape by jumping into the water....but even if touched squats down close....so is easily caught." The individuals I met at Chumar had this habit, but elsewhere, at Taiping, Bangkok, &c., I found them very agile and difficult to snare.

In captivity they feed readily, eating insects in the same manner as *R. temporaria* does; winged termites they devour in large numbers and will also manage grasshoppers of comparatively large size; when suddenly seized in the hand or when caught by a snake, they utter shrill piercing shrieks of alarm.

Colour (in life). Bangkok specimens not unfrequently have a very distinct grass-green vertebral line, others none at all; in the Dong Phya Fai the commonest colour-variety was one I have not seen elsewhere, there being transverse bands of bright grass-green across the back, but specimens with yellow vertebral lines were also to be seen. The sexes are coloured alike, except that the male may have a broad black **M**-shaped mark on the throat.

The following description applies to Taiping specimens:—

Above olive-brown, irregularly mottled with darker; vertebral line either absent, or well defined, narrow and yellow, or irregular, broad and orange-coloured. Limbs extensively marked with dark brown; hinder portion of thigh yellow, marbled with dark brown. Underneath of head, neck, and body pure white, but lower surface of limbs yellow. Both upper and lower lips white, with large distinct dark brown blotches; the point of the snout white, with a well-defined very dark brown blotch on each side.

Size. A pair caught *in copulâ* in Bangkok, 24th July, 1898, measured:—♂. Snout to vent 46 mm. ♀. Snout to vent 52 mm.

Distribution. Sikhim, India, Ceylon, Burma, China, Hongkong, Hainan, Formosa, Japan, Siam, Malay Peninsula, Java, Lombok, and Borneo.

11. RANA HASCHEANA (Stol.).

Polypedates hascheanus, Stol. J. A. S. B. 1870, p. 147, pl. ix. fig. 3.

I caught one apparently adult specimen on Penang Hill, at an elevation of 2000 feet, late at night in April 1898, it was very active; also many young ones in the same locality during March and April.

Colour (in life). Above rich yellow, with on the side very small dark brown spots more or less symmetrically arranged; a dark brown band between the eyes, edged with paler yellow in front, followed by a faint **W**-shaped mark, the ends of which begin behind the eyes; Stoliczka adds, "a pair of somewhat indistinct blackish spots below the middle of the body," these are just discernible in my specimen; sides of the head and neck rich dark brown, spotted with pale yellow, the most noticeable spot being a large irregularly shaped one behind the angle of the mouth; sides of body finely spotted with very dark brown and white; limbs with dark brown cross-bands; lower parts white, with pale purple

and golden shades, and an interrupted line of dark brown spots across the throat; as Stoliczka says, parts of the lower sides of body and limbs are "finely punctated with dusky."

Size. Length snout to vent 25 mm.

Distribution. Malay Peninsula, Natuna Island.

12. RANA ERYTHRÆA (Schleg.).

Rana erythræa, Blgr. Cat. Batr. Sal. p. 65.

"Katak pisang" of the Malays according to Mr. L. Wray. Personally I think "Kata' pisang" (or Banana Frog) is the proper Malay name for a *Rhacophorus*, but no doubt any frog with large digital disks would be considered a tree-frog and called by the same name.

Localities & Habits. I found this pretty frog fairly numerous on the Bangpakong river, from Tahkamen to Kabin, during March and April 1897, in places where there was long grass on the banks; also in ditches at Sapatoom, near Bangkok, in Jan. 1898, where its green and yellow colours exactly matched the leaves of the water lettuce (*Pistia stratiotes*[1]) among which it was to be found. In Taiping, Perak, in April 1898 it was very numerous in ponds and ditches; two individuals were caught in Penang, April 1898, and I also observed it near Alor Star, Kedah, in June 1898. It is a true water-frog, and appears to occur only at low elevations.

Colour. The Bangpakong frogs were more ornamental than Singapore specimens (*vide* P. Z. S. 1896, p. 203, pl. xlv. fig. 2), although the scheme of coloration was the same. They were as follows in life:—

Above brilliant green; along each side a line of similar green, separated from the green back by a broad light yellow line (from above the eye to the side of the vent), bordered above and below by broad lines of intense black; below the lateral green line is another line of pale golden yellow (from the angle of the mouth along the side, gradually narrowing and disappearing before it reaches the inset of the hind legs), bordered above by a broad line of intense black and below by an irregular line of dark green with iridescent golden shades. A black line on each side of the head from snout to eye; upper lip very pale golden yellow; tympanum dark rufous brown, with a bright green spot in the centre. Lower parts white, with pale iridescent golden shades. Limbs as in Singapore specimens, above yellowish brown speckled with dark brown, below immaculate buff. Iris: very narrow golden ring round pupil, remainder golden-bronze finely speckled with black.

Size. The large Siamese specimen measured, snout to vent 74 mm.

Distribution. Burma, Siam, Malay Peninsula, Sumatra, Borneo, Celebes, Philippines.

13. RANA MACRODACTYLA (Günther).

Rana macrodactyla, Blgr. Cat. Batr. Sal. p. 54.

Localities. Of this species, which had hitherto been recorded

[1] Kindly identified for me by Mr. H. N. Ridley, F.L.S.

from Burma and Southern China, I obtained many specimens near Jenan and Alor Star, Kedah, in June 1898, and near Sapatoom, Bangkok, Siam, in August 1898.

Habits. In each case they were living among swampy paddy-fields; they sat in the grass on the ridges between the submerged fields, and as one walked along took great leaps away into the water, which, however, they did not seem to like, as they nearly always at once swam back to the bank. They are remarkably nimble, active frogs, and specimens I had in captivity used to climb up a vertical surface of glass like a true tree-frog.

Colour (in life). Above rich dark brown, spotted with black, and in some individuals mottled with dull yellow and vivid green, with five very distinct longitudinal lines, which are white with golden shades (the centre line is from the snout to vent, the next pair from the upper eyelids to the sides of the vent, and the outer ones from the tympanum to the inset of hind leg). Below, head and body white, limbs yellowish. Upper surface of limbs reddish yellow, handsomely marked with dark brown, three lines along the back of the thigh being most conspicuous. Iris golden.

Size. Snout to vent 38 mm.; hind leg 63 mm.

Distribution. Burma, South China, Siam, Malay Peninsula.

14. RANA NIGROVITTATA (Blyth).

Rana nigrovittata, Blgr. Ann. Mus. Genova, (2) xiii. 1893, p. 334, pl. viii. fig. 3.

This species, not hitherto recorded from Siam, I found very numerous along the banks of the river at Muok Lek in the Dong Phya Fai, elevation 900 feet, in November 1897; both during the heat of the day, in the afternoon, and in the evening they kept up a continuous, loud and rather musical croaking, something like that of *Rhacophorus leucomystax*, only the note is louder and uttered much more often. They were very active.

Size. The largest specimen caught measured from snout to vent 58 mm.

Distribution. Burma, Siam.

15. RANA LABIALIS Blgr.

Rana labialis, Blgr. Ann. & Mag. Nat. Hist. (5) xix. 1887, p. 345, pl. x. fig. 1; S. Flower, P. Z. S. 1896, p. 903, pl. xlv. fig. 3 (tadpole).

In Sept. 1898 in Singapore I saw several specimens of this frog both in the Botanical Gardens and in the jungle on Bukit Timah; it was in each case observed sitting on the leaves of plants or in bushes, so evidently is not a true water-frog like *R. erythræa*. *Rana labialis* can change its colour rapidly from green to brown.

Distribution. Malay Peninsula and Mentawei Islands.

16. RANA LUCTUOSA (Peters).

Rana luctuosa, Blgr. Cat. Batr. Sal. p. 68.

Localities. Common on Penang Hill, elevation 2000 to 2200 feet (Nov. 1896 and March 1898), and obtained by Mr. A. L. Butler

in the Larut Hills, Perak, elevation 4000 feet, in March and April 1898.

Colour. In the P. Z. S. 1896, p. 904, I described the life coloration of this species, but having since then examined more specimens I think the following account to be more complete:—

Top of head and back rich dark chocolate-brown (in very small frogs of this species the back is a very bright red, more vermilion than chocolate), bordered on each side from the nose to above the vent by a very distinct line, usually all white but sometimes white only on the head, merging on the body to yellow and then orange. Sides of head, neck, and body are very dark brown or black; sometimes a very distinct line of lemon-yellow spots from behind the nostril to angle of mouth, smaller anteriorly and getting larger posteriorly; sides of the body with a few white spots in an irregular line from angle of mouth to thigh, or else extensively spotted with small white or yellow spots. Tympanum dark reddish brown, sometimes nearly black. Limbs very dark brown or bluish black, with marblings usually bluish white or very pale grey in colour but varying from white to orange; the hands, feet, and toes may have as dark a ground-colour as the limbs and as distinct light marblings, or the black may turn to brown and the marblings be less conspicuous.

Lower surfaces, chin, and throat dark brown, sometimes nearly black and immaculate (March), or dirty buff like the abdomen (Nov.); body dirty buff or dark brown mottled with yellowish buff; limbs brown, sometimes spotted with white. Iris pale golden bronze, extensively marked with very dark brown.

Size. An adult ♀ from Penang measured:—snout to vent 51 mm.; arm 30 mm.; leg 82 mm.

Distribution. Malay Peninsula, Borneo.

Tadpoles. Both in November 1896 and in March 1898 I found many tadpoles of this species in small ponds on Penang Hill, but none with legs developed (though in March 1896 there were tadpoles with legs and also recently transformed young frogs about, in the same locality); they agreed with those described and figured P. Z. S. 1896, p. 904, pl. xlvi., except that some had about 8 *long* papillæ along edge of lower lip.

17. RANA GLANDULOSA Blgr.

Rana glandulosa, Blgr. Cat. Batr. Sal. p. 73, pl. vii.

Known from Perak (specimen in Museum at Taiping), Malacca (*Hervey*), and Singapore (*Ridley*).

Distribution. Malay Peninsula, Borneo, Palawan.

18. RANA ESCULENTA L.

Rana esculenta, Blgr. Cat. Batr. Sal. p. 38.

The British Museum contains specimens of the variety *chinensis* Osbeck, from Bangkok, Siam.

Distribution. Central and Southern Europe, Northern Africa, Western Asia, Corea, Japan, China, Siam.

19. RANA LARUTENSIS Blgr.

Rana larutensis, Blgr. Ann. & Mag. N. H. (7) iii. 1899, p. 273, pl. xi. fig. 1.

In April 1898 these frogs were numerous sitting on the rocks in a swift rocky mountain-stream in the Larut Hills, Perak; their colour harmonized wonderfully well with their surroundings. They were difficult to catch, being exceedingly active jumpers and climbers.

Colour (in life). Above pale yellowish green, the head and body very extensively blotched with black, the limbs with black transverse bars. Below, head and body pure white, limbs pale green and grey, underneath of hands and feet very dark, and web between toes black. Iris: very narrow gold ring round pupil, remainder dark olive-brown.

Size. Snout to vent 60 mm.

Distribution. Malay Peninsula.

20.? RHACOPHORUS HECTICUS (Peters).

Rhacophorus hecticus, Blgr. Cat. Batr. Sal. p. 78.

In the Museum at Taiping there is a large tree-frog from Kinta, Perak, which is perhaps of this species.

Distribution. Samar Island in the Philippines, and possibly Malay Peninsula.

21. RHACOPHORUS LEUCOMYSTAX (Gravh.) (Plate LIX. figs. 3, 3*a*.)

Rhacophorus maculatus, part., Blgr. Cat. Batr. Sal. p. 83.

"Kata' pisang" of the Malays. ["Pisang"=banana.]

Localities. Since writing of this frog in the P. Z. S. 1896, p. 905, I have observed it in the following localities: Siam—Bangkok (June and July), Kabin (March), and obtained one young specimen from Chantaboon: Malay Peninsula—Singapore (March, April, May, September, and October); Larut Hills, Perak, 3400 ft. (April); Penang Hills, 2200 ft. (March, April, and November); Alor Star, Kedah (May and June); and there are specimens from Kuala Lumpor, Selangor, in the Museum at that place.

Habits. This species apparently breeds at various times of the year, specimens are frequently to be seen in the evenings *in copulâ* on the edges of the rain-water butts of houses, both in March and April (Singapore and Penang Hills) and in October (Singapore), and probably in other months also. The spawn floats on the surface of the water enclosed in an envelope resembling white foam. I have noticed tadpoles in the following months: January, February, March, April (Singapore); May (Kedah); June and July (Bangkok); November (Penang); December (Singapore); and newly transformed young were just leaving the water in September 1898 in Singapore.

Colour. Besides the six varieties of colour mentioned P. Z. S. 1896, p. 906, I have observed in one case on Penang Hill another

very noticeable one:—Upper parts pale cream-colour, a black line along each side starting from behind the eyes, some black spots on posterior part of back, and brown cross-bands on limbs.

Newly transformed young in Bangkok (June) were coloured as follows:—Above pale olive-brown, with on each side a black line from the snout passing through the eye to the inset of the hind leg; a black spot on each supraorbital region prolonged backwards to the neck as a black line, these lines converge but do not meet; on the shoulders are two diverging black lines; the remainder of the back is spotted with black; the hind limbs are transversely banded with dark brown; the lower surfaces are white.

Size. The largest of a series of adults examined on Penang Hill in March 1898 measured:— ♂. Snout to vent 51 mm.; hind leg 77; testicles, length 6 mm. ♀. Snout to vent 73 mm.; hind leg 107. Largest eggs in ovaries 2 mm. in diameter.

Distribution. Sikhim, Assam, Burma, Southern China, Hongkong, Formosa, Cambodia, Cochinchina, Siam, Malay Peninsula, Java, Sumba, Borneo, Celebes, Philippines.

Tadpoles. Specimens from Bangkok agreed with the description (P. Z. S. 1896, p. 906, pl. xliv. fig. 2), except for some differences in the mouth and in colour, which were as follows:—

Mouth. Beak broadly edged with black, lower mandible finely serrated along the cutting-edge; sides and lower edge of the lip bordered with small, short, round papillæ, except in the centre of the lower lip, where there is a space devoid of papillæ. Upper lip with *five* series of fine teeth, the uppermost uninterrupted, the second narrowly interrupted, the remainder broadly so, the fifth series is very short; lower lip with three long series of teeth, third narrowly interrupted, the other two uninterrupted.

Colour (in life). Above yellowish brown, mottled darker and lighter; below white, purplish grey on the throat; muscular portion of tail very pale brown, crests colourless and transparent; a very noticeable light yellow spot on the point of the snout; a dark brown line from corner of mouth to eye. Iris yellow.

A specimen from the Waterfall Gardens, Penang, agreed with these in having the 3rd series of teeth in the lower lip narrowly interrupted in the middle, but differed from them and from those originally described from Singapore in having at each of the upper corners of the mouth four long fine papillæ.

22. RHACOPHORUS NIGROPALMATUS (Blgr.).

Rhacophorus nigropalmatus, Blgr. Ann. & Mag. N. H. (6) xvi. p. 170 (1895).

In the Museum at Taiping is a single specimen of a large frog caught in Upper Perak by Mr. L. Wray (jun.); by his kind permission I was allowed to examine it.

Description. Vomerine teeth in a straight line between the front edges of the choanæ. Snout rounded. Canthus rostralis distinct. Loreal region decidedly concave. Nostril nearer the tip of the snout than the eye. Interorbital space broader than the upper eyelid. Tympanum half the width of the eye. Fingers and toes

webbed to the disks, which are as large as the tympanum. Subarticular tubercles distinct; a small inner metatarsal tubercle. The hind limb being carried forward along the body, the tibio-tarsal articulation reaches nearly to the nostril. Skin smooth, granulated very markedly on the belly and under the thighs. Fold round tympanum not noticeable. A large flap of skin behind the forearm. Cutaneous fringe on both 1st and 4th finger, and 1st and 5th toe. A transverse flap of skin above the vent, and a flap of skin on the tibio-tarsal articulation. Length, snout to vent, 98 mm.

Mr. Wray sent me the following note about this specimen, which has been identified by Mr. Boulenger.

"Flying Frog collected in Piah Valley, Upper Perak: above, it is a lovely bright green, with hands and feet tinted yellow and a white patch on each thigh. Below, it is pink dotted over with yellow. The sides of the body are chrome-yellow, and its webbed hands and feet are yellow and black."

In answer to further enquiries Mr. Wray tells me he did not see it fly, but caught it sitting on a tree. The name "Flying Frog" seems to be taken from A. R. Wallace ('The Malay Archipelago,' edition 1894, fig. on p. 30).

Distribution. Borneo and Malay Peninsula.

23. Rhacophorus leprosus (Schlegel).

Rhacophorus leprosus, Blgr. P. Z. S. 1890, p. 284.

This species has been obtained by Mr. Wray in the Larut Hills, and the Batang Padang Mountains, Perak (J. S. B. R. A. S. 1890, no. 21, p. 144).

Distribution. Malay Peninsula, Sumatra.

24. Ixalus pictus Peters.

Ixalus pictus, Blgr. Cat. Batr. Sal. p. 99; S. Flower, P. Z. S. 1896, p. 908.

Distribution. Malay Peninsula, Borneo.

25. Ixalus asper Blgr.

Ixalus asper, Blgr. P. Z. S. 1886, p. 415, pl. xxxix. fig. 1.

There are specimens, obtained by Mr. Wray in Perak, in the British Museum and in the local Museum at Taiping. Signor Fea obtained two specimens at Thao, Karin Hills (Blgr. Ann. Mus. Civ. Genova, series 2, vol. xiii. [xxxiii.] 1893, p. 37); and it is also recorded from hills between Burma and Siam (W. L. Sclater, P. Z. S. 1892, p. 347).

Distribution. Malay Peninsula, Burma.

Family Engystomatidæ.

26. Calophrynus pleurostigma Tschudi.

Calophrynus pleurostigma, Blgr. Cat. Batr. Sal. p. 158; S. Flower, P. Z. S. 1896, p. 908.

Localities. Of this interesting frog, which does not seem to have been previously recorded from Siam, I obtained a specimen at Bawtong, Kabin, in March 1897. I also got one near the foot of Gunong Pulai, Johore, in September 1897; and Mr. Ridley obtained a specimen in Selangor, in July 1897; these are the two first reported occurrences of this species on the mainland of the Peninsula.

Habits. Nothing is known definitely of the habits of this frog, but it is supposed to be the author of a remarkable strident call heard in certain Malay jungles, which may be written "waalk, waalk." There is a big field of interesting work in determining the animals whose voices are heard both by day and night in jungle-clad districts; neither the English pioneers nor the Malays know for certain what animals make some of the most noticeable jungle calls: as an instance I may mention that in June 1898 in the woods round Jenan, Kedah, a cry of "koop" was to be heard, even at high midday, which we imagined to be made by some batrachian, but diligent search on the part of several local Malays, my Siamese "boy," and myself failed to discover anything in the spots whence the sound seemed to have proceeded.

Colour (in life). Kabin specimen (March).—Above bright yellowish bronze; a broad dark brown line from snout to inset of hind leg, passing through eye. At inset of hind leg is a conspicuous black spot surrounded by a white ring, the greater part of the thighs is bright vermilion.

Johore specimen (September).—Above rusty red-brown; a narrow black line (bordered above with yellow) from snout to inset of hind leg, passing through eye. Just above where this black line terminates on either side of the back is a conspicuous round black spot. The lower surfaces are a paler red than the upper, and the lower aspect of the hind leg is marbled with dark brown on a buff ground.

Size. Kabin specimen, snout to vent 36 mm.

Distribution. Burma, South China, Siam, Malay Peninsula, Natunas, Borneo.

27. MICROHYLA ORNATA (Dum. & Bibron). (Plate LX. figs. 1, 1*a*, 1*b*.)

Microhyla ornata, Blgr. Cat. Batr. Sal. p. 165.

Localities. This little frog was obtained by M. Mouhot in Cambodia, but it does not seem to have been previously recorded from either Siam or the Malay Peninsula. I have found it in Bangkok in the months of Jan., Feb., March, April, May, June, July, August, and December; at Paknam Menam in August; in the Dong Phya Fai, at an elevation of about 900 feet, in November; at Ayuthia in February; at Kabin in March; at Chantaboon in January; and in the Royal Siamese Museum stores were some specimens labelled "Bangpain, Oct. '93." In March 1898 I obtained a single frog in the Waterfall Gardens, Penang, which is referred to this species; and in June 1898 found it numerous

near Alor Star in Kedah, and also near Jenan in the same State caught a particularly handsome little frog which is referred provisionally to *M. ornata*, but which differs considerably in appearance from Bangkok individuals.

Habits. This very active, elegant frog is to be found hiding during the day under stones, logs, &c. in the crevices of the mud in dried-up pools and among dead leaves. Once I found two in an ants' nest, situated in the ground under some brickwork. It comes out at dusk and seems to remain abroad all night. At night in December and January these frogs may be heard croaking in Bangkok; considering their small size they produce an astonishing volume of sound, the noise seems to me indescribable on paper.

Colour (in life). Usual Bangkok specimens.—Above reddish olive, with a large dark brown mark on the back beginning between the eyes, then narrowing and then widening as it extends to the hind part of the body; a broad darker brown line along the side of the head and body; limbs with irregular dark brown cross-bars; a dark horseshoe mark round the vent. Lower surfaces white, extensively spotted with brown on the throat and chest. Iris: golden ring round pupil, remainder golden speckled with bronze.

The Penang specimen was above yellow marked with rich dark brown, and below pale immaculate buff.

Size. The largest Siamese specimens noted measured—snout to vent, ♂ 22 mm., ♀ 23 mm. Penang specimen (sex not recorded), snout to vent 24 mm.

Distribution. Kashmir, India, Ceylon, Burma, Southern China, Cambodia, Siam, Malay Peninsula.

Tadpoles.

At the end of December 1896 I found tadpoles of this species in a small pond in Bangkok; they were numerous all through January and February 1897, and the young frogs were leaving the water at the beginning of March. On revisiting the same pond the following winter (1897–98) I failed to see a single specimen.

Description. Length of body once and three quarters its width, a little more than half the length of the tail. Nostrils placed close together on the upper surface of the head, nearer the end of the snout than the eye. Eyes on the sides of the body, visible from above and from below, their distance apart is about five times the distance between the nostrils, and also much greater than the width of the mouth. On the back between the eyes are a pair of shields, oval in outline, placed side by side; they are not conspicuous in the living tadpole, but in specimens shrunk in spirit they become so. Spiraculum median, on lower surface of body, opening into a transparent sheath of skin, in front of the anus. Anus median, opening in the lower edge of the subcaudal crest. Tail about four times as long as deep, ending in a very finely produced point; upper crest not extending on to the back;

lower crest deeper than the upper. The mouth has neither hard beak, labial teeth, or papillæ, but consists of a simple upper lip and a contractile lower one.

Colour. In life these tadpoles are transparent and almost colourless. The eyes and viscera are therefore very noticeable. But there are a number of minute yellowish-brown spots, particularly on the back, where they form a somewhat diamond-shaped figure, and on the muscular portion of the tail.

Size. Length of body 7 mm.; width of body 4 mm.; length of tail 13 mm.; depth of tail 3 mm.

The recently transformed young measure about 7·5 mm. from snout to vent.

A remarkable feature of these tadpoles is that the hind feet are for a time completely webbed, the web is very fine and colourless; when the young frogs leave the water this web disappears.

N.B.—At various times I have found in Penang some very remarkable tadpoles (Plate LX. figs. 2, 2*a*–2*c*), the affinities of which could not be conjectured, till, having made out the tadpole of *Microhyla ornata*, there seems no doubt they belong to some Engystomatoid Batrachian. Although the species they develop into is still unknown, I think it desirable to describe the tadpole in this paper. The first tadpoles with the spiraculum thus placed, and with this simple mouth, that I came across, I caught in Singapore early in 1896. At the time I imagined them to belong to *Callula pulchra* (and still do so), but was unable to prove it; on later occasions I have found these "transparent tadpoles" in Bangkok (where I was able to observe them grow into *M. ornata*), in the Dong Phya Fai, in Kedah, and on Penang Hill, all of which I have no doubt are of the genus *Microhyla*. These "transparent tadpoles" (of which I have observed four or five different species), besides differing in structure, differ entirely in habits from the tadpoles of the Ranidæ and Bufonidæ. Instead of passing a great deal of their time on the bottom, they are usually just under the surface of the water, continually opening and shutting their mouths; they are very delicate, and difficult to transport alive in a bottle even for a few miles.

Description of "Transparent Tadpoles," Penang
(Nov. and Dec. 1896).

Form. The length of the body is about $1\frac{1}{3}$ its width; the length of the tail is from $1\frac{1}{4}$ to $1\frac{5}{8}$ the length of the body.

Nostrils. Distance of nostrils apart 1·4 mm.; distance from nostril to end of snout 2·5 mm.; distance from nostril to eye 4 mm.

The nostrils are placed close together on the upper surface of the head, and are nearer the end of the snout than the eye. The distance to the eye is from $1\frac{1}{3}$ to $1\frac{3}{5}$ the distance to the end of the snout. The distance between the nostrils is about $\frac{1}{6}$ the distance between the eyes.

Eyes. Distance of eyes apart 7·5 mm. The eyes are on the side of the head (looking out horizontally), and are visible from above and from below.

Spiraculum. Distance of opening of spiraculum from the eye 10·5 mm. The spiraculum is median, on the lower surface of the body, opening into a transparent sheath of skin directed backwards and downwards; the opening being in a vertical line drawn *behind* the body. The width of the opening of the spiraculum is from 2 to 3 mm.

Anus. Median, opening into a dark-coloured sheath of skin directed backwards and downwards, behind and nearly parallel to the sheath of the spiraculum, but longer than it. The opening is a longitudinal cleft. These two tubes are very prominent in the live tadpole.

Tail. The tail is of remarkable appearance, owing to its coloration, the pigment in the crests ending abruptly, and also being continued further along the outside of the crest than along the part nearest the muscular portion; consequently the tadpole when seen alive in the water has apparently a trifurcated tail, a very long centre point and short upper and lower one. The end of the tail is prolonged to a very fine point or filament, which in life is almost continuously being vibrated rapidly from side to side, the end frequently curving round so as to be almost parallel with the rest of the tail. The upper crest is convex and does not extend on to the back. The lower crest is deeper than the upper, and forms a double curve, the deeper being that behind the opening of the anus.

Mouth. The mouth is 3·5 to 4 mm. in width.

The mouth is situated at the extremity of the head, and *not* on the lower surface; the lower lip projects beyond the upper: this is particularly so in young specimens, where the mouth appears to be on the upper surface of the head. These young tadpoles frequent the surface of the water, and their mouths are constantly expanding and contracting (which words seem to imply the motion better than "opening and shutting").

There are no papillæ round the lips, labial teeth or horny beak, but the mouth consists of simple upper and lower lips, the latter with a very deep notch in the centre which expands when the mouth is open.

Colour (in life). These tadpoles are very transparent and the amount of colouring varies in individuals. The upper surfaces and sides of the hinder parts of the body are generally yellowish brown, mottled along the vertebral line with very dark brown. The lower surfaces and sides of the head are colourless or a pale dirty buff. The muscular portion of the tail is pale yellowish brown, getting darker towards the point. The crests are buff mottled with yellowish brown, along both edges are irregular dark brown marks; the brown mottling gets more continuous and darker towards the point of the tail till it ends abruptly, as described above. Iris bright yellow.

Size. A good specimen with hind legs developed was in total length 37·5 mm.; length of body 13·5 mm.; width of body 10 mm.; length of tail 24 mm.; depth of tail 11 mm.

The toes are fully webbed and tips well dilated.

28. MICROHYLA INORNATA Blgr.

Microhyla inornata, Blgr. P. Z. S. 1890, p. 37.

This little frog was described from specimens obtained by Prof. Moesch near Deli, Western Sumatra (P. Z. S. 1890, p. 37); subsequently it was found at Palon, Pegu, by Signor Fea (Blgr. Ann. Mus. Civ. Genova, 1893, p. 39), and near Bangkok, Siam, by the late Dr. E. Haase (Boettger, Zool. Anzeiger, 1893, no. 433, p. 430). I have not met this species alive myself, but I received a number of specimens said to have been caught at Chantaboon, Siam.

Distribution. Burma, Siam, Sumatra.

29. MICROHYLA LEUCOSTIGMA Blgr.

Microhyla leucostigma, Blgr. Ann. & Mag. Nat. Hist. (7) vol. iii. 1899, p. 275, pl. xii. fig. 1.

I obtained three specimens in the Larut Hills, Perak, at an elevation of 3500 feet in April 1898; two of these (the types) are now in the British Museum, and the third in the Raffles Museum at Singapore. A pair were caught *in copulâ*: as the mode of embrace does not seem to have been recorded for any Asiatic Engystomatoid Batrachian, it is interesting to note the embrace was axillary, and the fingers of the male did not meet on the breast of the female.

Colour (in life). Above intense iridescent black, with very small scattered bluish-white spots, which get larger towards the sides and in the anal region. Below very rich dark brown (blacker on the throat, redder on the belly and thighs), nearly covered with large very distinctly defined spots of intense yellow. Upper surface of limbs reddish brown, with black cross-bars, and thickly studded with very small white spots. Upper surface of hands and feet brown, with bright yellow spots. Lower surface of hands and feet reddish brown. Iris very dark brown, very minutely spotted with pale gold. Pupil circular. The sexes do not appear to differ in coloration.

Size. ♂. Snout to vent 25 mm.; arm 14; leg 39.

♀. Snout to vent 27 mm.; arm 15·5; leg 40·5.

Distribution. Malay Peninsula (Perak). Mr. Boulenger informs me the same frog has been discovered in Borneo, on the Baram river, by Mr. C. Hose.

30. MICROHYLA PULCHRA (Hallow.).

Microhyla pulchra, Blgr. Cat. Batr. Sal. p. 165.

M. Mouhot obtained this species in Cambodia, and I found a single specimen under a stone in the Dong Phya Fai, Siam, in

November 1897. It is a singularly handsomely marked frog, and well merits its specific name of *pulchra*.

Distribution. Siam, Cambodia, China, Hongkong.

31. MICROHYLA ACHATINA (Boie).

Microhyla achatina, Blgr. Cat. Batr. Sal. p. 166.

Localities. This pretty little frog was known to inhabit the Malay Peninsula from ♂ and ♀ specimens sent to the British Museum from Malacca by Mr. D. F. A. Hervey; it does not seem to have been previously recorded from Siam. I have obtained specimens on Penang Hill, at from 2000 to 2500 feet elevation, in Nov. 1896 and April 1898; in Taiping, Perak, in May 1898; in Bangkok in July 1898; in the Dong Phya Fai, about 900 feet elevation, in Nov. 1897; and I have received specimens from Chantoboon.

Habits. A very active frog; at times taking very sudden, long hops like a "grasshopper" insect, at others using its dilated digital disks in climbing like a true tree-frog.

Colour (in life). Upper parts vary from very pale light bronze-brown to rich bronze-red, speckled in irregular longitudinal lines, with very small dark brown spots, a very pale yellow vertebral line, and a conspicuous dark brown or black pattern on the back. The sides are rich dark brown or black. Lower parts purplish buff. Iris golden.

Size. Snout to vent 20 mm.

Distribution. Tenasserim, Siam, Malay Peninsula, Sumatra, Java, Moluccas.

32. MICROHYLA BERDMORII (Blyth).

Microhyla berdmorii, Blgr. Cat. Batr. Sal. p. 166.

Localities. This species, although known from Burma, Malacca (*Davison*), and Cambodia, does not seem to have been recorded from Siam. In Nov. 1897 I found it numerous near Hinlap, in the Dong Phya Fai, Siam, elevation about 700 feet.

Habits. Nocturnal, frequenting the neighbourhood of water, an extraordinary good jumper (even for a frog).

Size. Snout to vent 43 mm.

Distribution. Burma, Siam, Cambodia, Malay Peninsula.

33. CALLULA PULCHRA (Gray).

Hylædactylus bivittatus, Cantor, p. 143.

Callula pulchra, Blgr. Cat. Batr. Sal. p. 170 (hand &c. fig.); S. Flower, P. Z. S. 1896, p. 908.

"Eung-ahng" of the Siamese.

"Bull Frog" of the English in Singapore and Siam.

Localities. This species apparently does not occur in Penang; but is now common in Singapore, having been (from all accounts) imported into that island from Siam. The only instances of its occurrence on the mainland of the Peninsula (that I know of) are

the single male obtained from a field near Malacca by Cantor, and specimens in the Museum at Kuala Lumpor, from that place, where it is said to be common. In Siam I have observed it in Bangkok (Jan., May, June, July, Aug., Nov., and Dec.), at Paknam Menam (Aug.), at Tahkamen on the Bangpakong river (April), and I have also received specimens from Chantaboon.

Habits. From having kept many specimens in captivity for months at a time, and also observed them frequently in their native haunts, I think *Callula pulchra* is the cleverest batrachian I have come across: they are good swimmers, can hop well on land and also climb fairly, though slowly; ours in captivity in the evening often go up the glass side of their case, but they manage better in a corner than on a plain vertical glass wall. During the rains, when every evening swarms of insects flew into the house attracted by the light and were a great annoyance at dinner-time, we were in the habit of putting a *Callula* or two on the dinner-table: they seemed to understand what they were there for, and instead of jumping off the table or being alarmed by us or the servants, caught and ate the flying insects, one after another, as they alighted on the cloth. Termites, ants, moths, small beetles, crickets, and grasshoppers they devour eagerly, but the larger crickets and grasshoppers they cannot manage to hold to get them into their small mouths; they seem more clever in catching their desired prey than either *Rana* or *Bufo*, and also show curious discrimination in not attempting to seize the winged bugs, which often come into the house at the same time as the swarms of ants, termites, &c.

During the rainy season in Bangkok almost every evening, after a wet day, the whole air is full of the booming of these frogs—"eung-ahng, eung-ahng, eung-ahng," now rising, now falling, and the sound continues all night. In some of the roads where there is low land and much water on each side, and *Callula* swarms, you can hardly hear yourself speak for the noise, but at the distance of a quarter or half a mile the sound is not unpleasant and is like that of a great weir or waterfall. In Singapore possibly they croak on suitable evenings all the year round; personally I have noted them doing so in the months of March, April, May, June, July, September, October, and December. In captivity they continue to make their characteristic sound; also apparently they can make a quite different noise: on more than one occasion we were disturbed at night in Bangkok by shrill screams apparently of a person in great fear and pain; the noise seemed to come from the room where the *Callula* were kept, but on procuring a light and going there, I found them sitting quietly in their vivarium as if nothing had occurred, so it cannot be proved that they were the authors of these really alarming cries[1].

[1] Our knowledge of the strange cries that animals make at times must still be very meagre. Various noises occurred from time to time in the old ruinous palace I lived in at Bangkok that I did not succeed in tracing: the natives (as usual) attributed them to the supernatural, but I have no doubt they were

I have been told the Laos eat *Callula pulchra*, but the Siamese in Bangkok do not, though they esteem *Rana tigrina* as food.

Distribution. India, Ceylon, Burma, South China, Siam, Cambodia, Malay Peninsula, Celebes.

34. PHRYNELLA PULCHRA Blgr.

Phrynella pulchra, Blgr. A. M. N. H. (5) xix. 1887, p. 346, pl. x. fig. 2.

Distribution. Malay Peninsula (Malacca), Sumatra, Mentawei Islands.

35. PHRYNELLA POLLICARIS Blgr.

Phrynella pulchra, Günth. A. M. N. H. (5) xx. 1887, p. 313, pl. xvi. fig. B; L. Wray, J. S. B. R. A. S. 1890, no. 21, p. 141.

Phrynella pollicaris, Blgr. P. Z. S. 1890, p. 37.

Distribution. Malay Peninsula (Perak).

Family BUFONIDÆ.

36. NECTOPHRYNE GUENTHERI Blgr.

Nectophryne guentheri, Blgr. Cat. Batr. Sal. p. 280, pl. xviii. fig. 3; S. Flower, P. Z. S. 1896, p. 910.

Mr. Ridley obtained another specimen on Bukit Timah, Singapore, in March 1898.

Distribution. Malay Peninsula (Singapore), Mentawei Islands, Natuna Islands, Borneo.

37. BUFO PENANGENSIS (Stol.). (Plate LX. figs. 3, 3*a*.)

Ansonia penangensis, Stol. J. A. S. B. 1870, p. 152, pl. ix. fig. 4.

Bufo penangensis, Blgr. Cat. Batr. Sal. p. 287.

Localities. I have found this species in the hills of Penang, elevation 2000 feet, in March 1898, and in the Larut Hills, Perak, elevation 3000 feet, in April 1898. Dr. Hanitsch (Rep. Raffles Libr. & Mus. 1898, p. 5) records specimens from Gunang, Kledang, Perak, elevation 2100 feet, caught in March 1898.

Habits. My Penang specimens I caught after dark hopping on the ground on paths through the hill-jungle; the Larut specimens I found by daylight crouching on the nearly vertical face of some rocks on the side of a rushing mountain-stream: they were easily caught in the hands. The iris in life is golden.

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made by animals, probably reptiles or batrachians, that we generally consider to be mute. I have not seen it recorded that the Lizard *Uromastix ægyptius* has a voice, but specimens now living in my house here often make a low noise, a sort of guttural cackling, audible 3 or 4 yards off. *Testudo marginata* at times utters a plaintive cry, very like a sheep bleating; and *Testudo radiata* has a low querulous bark; probably many other instances could be given.—S. S. F., Ghizeh, Egypt: 13-5-99.

Size. The largest specimen from Penang measured, snout to vent, 37 mm.

Distribution. Malay Peninsula, Borneo.

Tadpole.

Tadpoles and newly transformed young toads were found in abundance in two streams on Penang Hill, at elevations of about 1800 feet, during March 1898.

Habits. These tadpoles live in the swift-flowing hill-streams, and are to be found where the torrent is rushing fastest, fixed to the face of the granite boulders which obstruct the stream; a favourite place of theirs was a perpendicular wall of rock which the water fell over in a small cascade; they hold on so fast with their mouths that they cannot easily be pulled off, but have to be plucked away from the rock between one's finger and thumb. They move upstream and about the face of the rock by means of their mouths; when placed in a glass bowl they never laid on the bottom (as most tadpoles do), and seldom swam about but fixed themselves to the glass sides. In captivity they died in a few hours, the still water probably not suiting them.

Description of the Tadpole (in the 3rd period).

Form. Length of body from rather more than once and a half to rather less than once and two thirds its width, nearly half the length of the tail. Nostrils much nearer the eyes than the end of the snout, about a quarter the distance. Eyes on the sides of the head, looking outwards and upwards, not at all prominent in life; the distance between the eyes is rather more than once and a half as great as that between the nostrils, and little more than half as great as the width of the mouth. A strongly marked lachrymal canal from in front of the eye to the nostril. Spiraculum on the left side, directed backwards and upwards, rather nearer the eye than the anus, not at all prominent in life. Anus median. Tail six times as long as deep, acutely pointed; upper crest only on posterior two-thirds of tail, lower crest whole length of tail, but only the posterior two-thirds are pigmented; crests of equal depth or lower slightly deeper.

Mouth. The large mouth forms an organ for adhesion and locomotion. Beak white; lower jaw edged with black, upper with a conspicuous black diagonal mark on each side. The lips form the rim of a sucking-disk, when not fully expanded they take a crenular form (in spirit-specimens this is very marked); the upper lip, which has its edge turned in and terminating in the 1st row of upper labial teeth, is smooth and free from papillæ; the enlarged muscular lower lip is thickly studded with very small short rounded papillæ. There are two uninterrupted series of upper labial teeth of equal length, the 2nd being slightly stronger than the 1st: three uninterrupted series of lower labial teeth of equal length but shorter than the upper series; the 3rd is the strongest and the 1st the weakest.

Colour (in life). Upper surface sepia-brown, mottled darker and lighter; the disk round the head is translucent, colour yellow very finely speckled with sepia-brown. Lower surface yellowish buff, the intestines showing the transparent skin as a dark purplish patch. Muscular portion of tail sepia-brown mottled with yellow; the crests are transparent, finely speckled with sepia-brown towards their edges, which are dark brown. The legs as soon as they appear have the bright colour and distinct markings of those of the young toad; when the fore limbs appear the back begins to take the markings of that of the young toad. Iris, a narrow ring of reddish yellow.

Colour (in life) of newly transformed young.—Upper surface of head and body yellowish brown, extensively marked with black; sides of head and body spotted with orange and yellow. Limbs red, with dark brown cross-bars. Below purplish grey, with numerous very small whitish-yellow spots.

Size. Tadpoles (3rd period): total length 34 mm.; length of body 12·5; width of body 7; width of mouth 6; length of tail 21·5; depth of tail 3·5; depth of mouth 5.

Newly transformed young: snout to vent 13 to 14 mm.

38. Bufo melanostictus Schneid.

Bufo melanostictus, Cantor, p. 142; Blgr. Cat. Batr. Sal. p. 306; Blgr. Faun. Brit. Ind., Rept. p. 505 (fig. p. 506).; S. Flower, P. Z. S. 1896, p. 911, pl. xliv. fig. 3 (tadpole).

"Kákong," "Kátak púru," of the Malays of the Peninsula, according to Cantor.

"King-kop" of the Siamese.

Localities. This is the common toad of the Malay Peninsula and Siam, to be found in abundance at all seasons of the year; I have observed it in the following localities:—Penang (from sea-level to the summit of Western Hill, 2725 feet); Alor Star, Anak Bukit and Kulim, Kedah; Taiping, Perak; Johore Bahru; Singapore; Paknam Menam, Bangkok, Ayuthia, Pachim, Kabin, and Chantaboon in Siam; and at Kosichang, an island in the Gulf of Siam, where exceptionally large individuals were seen. Specimens from the same localities vary considerably in roughness, some are nearly covered with strong spinous warts.

Habits. This species resembles *Bufo vulgaris* in habits and manner of feeding, and does well in captivity, readily eating beetles, termites, ants, crickets, grasshoppers, &c., but refusing millipedes. As a rule it frequents cultivated places, or the neighbourhood of paths and clearings, only once have I found a specimen in virgin jungle. At certain seasons the males make a good deal of noise croaking, both when wild or when kept in a vivarium; while croaking the single vocal sac under the chin is distended into a globular form. I have heard them croaking in February (at Ayuthia), in March (at Pach'n), in July (at Bangkok), and in November (in the Penang Hills). The Siamese are much afraid of toads; a man I employed

in collecting would handle frogs, snakes, lizards, &c., and pick up scorpions, large spiders, &c., but could never be persuaded to even touch a toad.

Colour. In the breeding-season the males assume a very handsome appearance, the throat becoming bright chrome-yellow, and the sides of the head and chest yellow, spotted with black.

Size. The largest Bangkok specimen measured 116 mm. from snout to vent.

Distribution. India, Ceylon, Burma, Sikhim Himalayas (up to 10,000 feet), Southern China, Hongkong, Cambodia, Siam, Malay Peninsula, Java, Borneo, Philippines.

Tadpoles.

I have observed the tadpole of *B. melanostictus* in April and October in Singapore; in March in Penang (mouth exactly as described in P. Z. S. 1896, p. 912; but colour of caudal crests almost none, transparent); in July and August in Bangkok; and at Batu Gajah, Perak, in December I caught a tadpole exactly like those of this species, except that the 2nd series of teeth in the upper jaw was uninterrupted.

39. BUFO MACROTIS Blgr.

Bufo macrotis, Blgr. Ann. Mus. Civic. Genova, (2) v. 1887, p. 422, pl. iv. fig. 3; Blgr. Faun. Brit. Ind., Rept. p. 502.

Localities. This toad, previously known from Upper Burma and Pegu, has not been recorded from Siam before. I found it fairly numerous at Bawtong Kabin in March 1897. This species and *B. melanostictus* frequented the same spots.

Size. Snout to vent 46 mm.

Distribution. Burma, Siam.

40. BUFO PARVUS Blgr.

Bufo parvus Blgr. A. M. N. H. (5) xix. 1887, p. 346, pl. x.

In November 1896 I found a single specimen under some dead leaves in jungle by the Waterfall Gardens, Penang. It was a very active toad, hopping like a frog; in captivity it refused to feed. The eyes are large and prominent, and the tympanum very distinct.

Colour (in life). Above rich dark reddish brown; limbs dark brown mottled with light red. Below yellowish buff and purplish grey, speckled on the chin, throat, chest, and lower legs with dark brown. Iris golden and vandyke-brown, minutely speckled with black.

Distribution. Pegu, Malay Peninsula, Sumatra.

41. BUFO QUADRIPORCATUS Blgr.

Bufo quadriporcatus, Blgr. A. M. N. H. (5) xix. 1887, p. 347, pl. x. fig. 4; Günth. A. M. N. H. (5) xx. 1887, p. 314, pl. xvi. fig. C.

Distribution. Malay Peninsula (Perak and Malacca), Sumatra, Borneo.

N.B.—Mr. L. Wray (Perak Museum Notes, vol. ii. part ii. p. 135) credits me with having presented the Museum at Taiping with a toad of this species from Penang; the toad in question, however, was a specimen of *B. asper*.

42. BUFO DIVERGENS Peters.

Mr. A. L. Butler informs me he has obtained this species in Salangor during the latter half of 1898; it had not previously been recorded from the Malay Peninsula.

Distribution. Malay Peninsula.

43. BUFO ASPER Gravenh.

Bufo asper, Blgr. Cat. Batr. Sal. p. 313; S. Flower, P. Z. S. 1896, p. 912.

This is the grandest batrachian known to inhabit the Malay Peninsula, and interesting in many ways: its size, rugged coat, and prominent yellow eyes at once attract attention; its muscular strength is unusually great for an animal of this class; the strong scent of musk it gives out when excited or alarmed is remarkable; its habit of pretending to be dead is very curious; and, lastly, its motive for frequenting only particular caves and waterfalls would be most interesting to work out.

For this reason I give each place and date on which I have met the species:—

Great Waterfall, Botanical Gdns., Penang:			24.3.95; four.
,,	,,	,,	30.3.95; two (♂ ♂).
,,	,,	,,	24.4.26; three (♀.)
,,	,,	,,	8.3.98; two.
,,	,,	,,	14.6.98; one.

On 1st Jan., 1896, I searched this place without seeing a single toad.

Penang Hill, elevation about 2000 feet; 26th November, 1896, one individual.

Penang Hill, elevation about 2000 feet; April 1898, three individuals.

Batu Caves, Selangor, 28th and 30th June, 1898. In the dark part of these caves there were numbers of *B. asper*; on the 28th I saw about twenty individuals, some were several hundred yards underground (perhaps half a mile) and in places where no daylight could ever penetrate. All the toads seen in the caves were well-grown specimens, apparently adult; their rugged backs and colour exactly match many of the rocks in the caves. The excrement of these toads contained wings of small beetles and cockroaches.

Colour (in life). General colour varies from yellowish brown, irregularly darker on upper surface, to rich reddish brown and blackish. Iris: a narrow golden line round pupil, remainder golden, very finely speckled and vermiculated with very dark bronze.

Size. Largest Penang specimen I have measured was, snout to vent 170 mm. (6⅔ inches).

Distribution. Tenasserim, Mergui, Malay Peninsula, Java, Borneo.

N.B.—BUFO GALEATUS Günther.

Bufo galeatus, Blgr. Cat. Batr. Sal. p. 314.

The type specimen, a female, was obtained by M. Mouhot in Cambodia, so the species may be eventually found in Siam.

Family PELOBATIDÆ.

44. LEPTOBRACHIUM HASSELTI Tschudi.

Leptobrachium hasseltii, Blgr. Cat. Batr. Sal. p. 441; S. Flower, P. Z. S. 1896, p. 913; Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 8.

Distributim. Burma, Malay Peninsula, Java.

45. MEGALOPHRYS NASUTA (Schleg.).

Megalophrys montana var., Cantor, p. 140; part., Günth. Rept. Brit. Ind. p. 413.

Megalophrys nasuta, Blgr. Cat. Batr. Sal. p. 443; S. Flower, P. Z. S. 1896, p. 913.

"Katah bertandu" of the Malays of Perak, according to L. Wray, jun.

Cantor obtained two specimens on the Pentland Hills, Penang, at an elevation of about 1800 feet. When in Penang during March and April 1898, I obtained one adult specimen from a valley; and two adults, two small specimens, and many recently transformed young from the hills at elevations of from 1800 to 2000 feet. This species is also found in Perak (specimens in British and local Museums); in Selangor (one specimen in local Museum, caught about 15 miles from Kuala Lumpor, 1898); Malacca (Raffles Museum); Johore (Raffles Mus.); and on Bukit Timah, Singapore (Raffles Mus.).

Colour. Cantor gives a good description of this species, but says "above, pale greyish-brown;" in four specimens which I observed alive for several days I found they were capable of altering their colour to a great extent—olive-brown, red-bronze, yellowish bronze or chocolate, but in every case the colours and shades resembled those seen in dead leaves; the rich dark-brown

markings on the sides vary very much in intensity from time to time.

Size. ♂ from Penang: snout to vent 80 mm.; width of head at angle of jaw 36 mm.

♀ from Penang: snout to vent 90 mm.; width of head at angle of jaw 46 mm.

Distribution. Malay Peninsula, Sumatra, Borneo.

N.B.—MEGALOPHRYS MONTANA Kuhl.

Megalophrys montana, Blgr. Cat. Batr. Sal. p. 442.

A frog in the Museum at Taiping, said to have been caught in Perak, apparently belongs to this species.

Distribution. Java, Sumatra, Dinagat Island; Malay Peninsula (possibly).

46. MEGALOPHRYS LONGIPES Blgr.

Megalophrys longipes, Blgr. P. Z. S. 1885, p. 850, pl. lv.; Günth. A. M. N. H. (5) xx. 1887, p. 316.

This species was first discovered by Mr. Wray; in April 1898 Mr. Keilich again obtained it in the Larut Hills in Perak, at an elevation of 4500 feet.

Distribution. Malay Peninsula (Perak).

Order **CAUDATA.**

Family SALAMANDRIDÆ.

47. AMBLYSTOMA PERSIMILE (Gray).

Amblystoma persimile, Blgr. Cat. Batr. Grad. &c. p. 47.

Two specimens were collected by M. Mouhot in Siam, "probably at a considerable altitude."

Distribution. Siam.

Order **APODA.**

Family CÆCILIIDÆ.

48. ICHTHYOPHIS GLUTINOSUS (Linn.).

Epicrium glutinosum, Günth. Rept. Brit. Ind. p. 441 (1864).

Ichthyophis glutinosus, Blgr. Cat. Batr. Grad. &c. p. 89, pl. iv. fig. 2 (1882); Blgr. Faun. Brit. Ind., Rept. p. 515, fig. p. 516 (1890).

"Ngu pling" or "leech-snake" of the Siamese.

I have come across the following specimens :—

	Locality.		Number of circular folds,	Approximate length in millimetres.
(i)	Bangkok		356	350
(ii)	,,	(Feb. 1898)	320	304
(iii) *	,,	.....	294	294
(iv) *	,,	.....	312	282
(v) *	,,	.....	305	180
(vi) *	,,	.....	308	136
(vii)	Ayuthia (June 1897)		—	—
(viii)	Chantaboon		332	304
(ix) *	Penang, 1800 ft.	(April 1898)	311	297
(x) *	,,		285	290
(xi) *	,,		317	287
(xii) *	,,		313	196
(xiii) *	,,	(March 1898)	298	188
(xiv) *	,,	(April 1898).	294	174

The counted number of circular folds must always be more or less approximate, as they are not all complete rings, some bifurcating in places; but this table shows how very much they vary in number in individuals regardless of the length.

Mr. Wray has shown me a specimen obtained by him in the Larut Hills, Perak, at between 3000 and 4000 feet elevation, and Mr. A. G. B. Van Sommeren had in his collection one from the Penang Hills from about 2200 feet. Dr. Hanitsch (Rep. Raffl. Libr. & Mus. 1898, p. 5) records specimens from Ipoh, Kinta district of Perak, caught November 1897, and from Gunong Panti, Johore, caught June 1898.

Habits. In life the tentacles are constantly being protruded and retracted, and the throat is in constant motion, like a frog's. These creatures are gentle and make no attempt to bite; although their usual movements are very slow and deliberate, when they want to they can wriggle away with surprising speed. They do not feel at all slimy when handled.

These remarks apply equally well to *I. monochrous*.

Colour (in life). Very dark rich purple, each circular fold showing as a narrow paler ring. Along each side of the body a bright lemon-yellow line, very distinct and sharply defined at the edges, but varying very much in width in specimens of about equal length. The eyes, though so small, are bright; they are black, with a very narrow pale brown ring round them. The tentacles are white.

Distribution. Mountains of Ceylon, Malabar, Eastern Himalayas, Khási Hills, Burma, Siam, Malay Peninsula, Sumatra, Mentawei Islands, Borneo, Java.

* In the ten specimens marked with an asterisk the tentacle is considerably nearer the eye than the nostril; of its position in the remaining specimens I find I have made no note.

49. ICHTHYOPHIS MONOCHROUS (Blkr.).

Ichthyophis monochrous, Blgr. Cat. Batr. Grad. &c. p. 91, pl. iv. fig. 1 (1882).

In April 1898 on different days I obtained two specimens from under a stack of firewood near "Maxwell's Bungalow," in the Larut Hills, Perak, elevation 3380 feet.

1st. Number of circular folds about 313; length 208 mm.

2nd. Number of circular folds about 309; length 167 mm.

As in *I. glutinosus*, some of the circular folds either bifurcate or converge into each other; therefore the number, in counting the same individual at different parts of its circumference, varies.

Colour (in life). Uniform purplish black. Tentacles white. Anal region and tip of tail pale pinkish. The eye appears as an inconspicuous black speck (but turns whitish in spirits).

Distribution. India (Sikhim, Western Ghauts, Surat, Malabar), Malay Peninsula, Borneo, Java.

ADDENDA.—Mr. A. L. Butler has recently obtained in the Malay Peninsula examples of two species not included in this list—*Rana jerboa* from the Batu Caves, Selangor, and *Nectes subasper* from Sungei Buloh: he also obtained in Kuala Sumpor a male *Rana macrodon*, measuring "exactly nine inches" (228½ mm.) from snout to vent.

EXPLANATION OF THE PLATES.

PLATE LIX.

Fig. 1. *Rana macrodon* (p. 888). Tadpole. × 2.
1*a*. „ „ „ mouth. × 15.
2. *Rana tigrina* (p. 891). Tadpole. × 1½.
2*a*. „ „ „ mouth. × 10.
3. *Rhacophorus leucomystax* (p. 898). Tadpoles. × 1½.
3*a*. „ „ Tadpole, mouth, much enlarged.

PLATE LX.

Fig. 1, 1*a*, 1*b*. *Microhyla ornata* (p. 901). Tadpoles. × 4.
2. *Microhyla* (?), sp. ? (p. 903). Tadpole, side view and upper view. × 3.
2*a*. „ „ „ front view of mouth, shut. × 6.
2*b*. „ „ „ front view of mouth, open. × 6.
2*c*. „ „ „ side view of mouth, shut. × 3.
3. *Bufo penangensis* (p. 908). Tadpole, upper and lower views. × 2.
3*a*. „ „ „ mouth. × 5.

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MALE CHILIAN GUEMAL.
(Mazama bisulca.)

4. Specific Characters of the Chilian Guemal.

By R. Lydekker.

[Received August 30, 1899.]

(Plate LXI.)

When describing that subgeneric group of American Deer commonly known as Guemals in 'Deer of All Lands,' I had no mounted specimen of the Chilian species to compare with the one of the Peruvian Guemal in the British Museum; the latter having suffered considerably from fading. Consequently, I was compelled to rely on the descriptions of others; and now that the Museum (thanks to Dr. H. P. Moreno) has acquired a beautiful male of the Chilian Guemal, I find that there are several inaccuracies in my description.

In the first place, the Chilian Guemal is a considerably larger animal than the Peruvian species, the shoulder-height in the mounted specimens of these species in the Museum being respectively 39½ and 33½ inches. Secondly, it is much more uniformly coloured than its northern relative, the greater portion of the under-parts, limbs, and buttocks being of the same tint as the back, instead of very much lighter. The faded condition of the Museum specimen of the Peruvian species does not admit of the original tint of the hair being precisely determined; but it was evidently speckled after the manner of the Chilian form. In the latter, the general colour of the head and upper-parts is bright greyish-yellow speckled with black. A broad black band runs up the middle of the face from the muzzle to terminate in a fork between the eyes; the sides of the muzzle being brown and the extremity of the chin whitish. The upper surface of the tail is coloured like the back, while the under surface is white; there is no trace of the brown patch on the rump and the brown upper surface of the root of the tail characteristic of the Peruvian species. The under-parts and limbs, with the exception of the inguinal region, the front and upper part of the inner surface of the thighs, and a streak on the postero-internal surface of the fore legs (which are greyish white), are also coloured like the back; thus presenting a very striking difference from the Peruvian animal, in which they are very much lighter. The tarsal tuft, too, instead of being dark umber-brown on a whitish ground, is likewise of the same speckled hue as the upper-parts.

In regard to the antlers, they are distinguished from those of the Chilian species by the forking taking place at a considerably greater distance above the burr, so that between the latter and the upper surface of the fork there is an interval of nearly two inches instead of less than an inch.

The antlers of the specimen figured in the drawing (Plate LXI.), which came from Patagonia, are comparatively thin and smooth. In a head from Ultima Esperanza, Patagonia, recently acquired by the

Museum, the antlers are, however, much stouter and more rugose, perhaps indicating an older animal. Moreover, in the same specimen (represented in the figure, p. 918) the general tone of the hair is greyer and less rufous, while the black mark on the face

Head of an adult male Chilian Guemal (*Mazama bisulca*).

is narrower and less deep in colour. Now this specimen is stated to have been killed in June, that is to say in the middle of winter. And it would accordingly seem that the Guemals, like so many

Deer, exhibit a reddish phase in summer, and a more greyish (blue) tint in winter.

The Chilian Guemal was originally named from specimens obtained in the Andes of the country from which it takes its popular title; probably on the east side of the main range. I can find no reason for separating the Patagonian animal, even racially. It has sometimes occurred to me that the Peruvian and Chilian Guemals might be nothing more than local forms of one widely-spread species; but the important points of difference indicated above leave little doubt as to the propriety of regarding them in the light of separate species.

5. On the Skull of a Shark-toothed Dolphin from Patagonia. By R. Lydekker.

[Received September 7, 1899.]

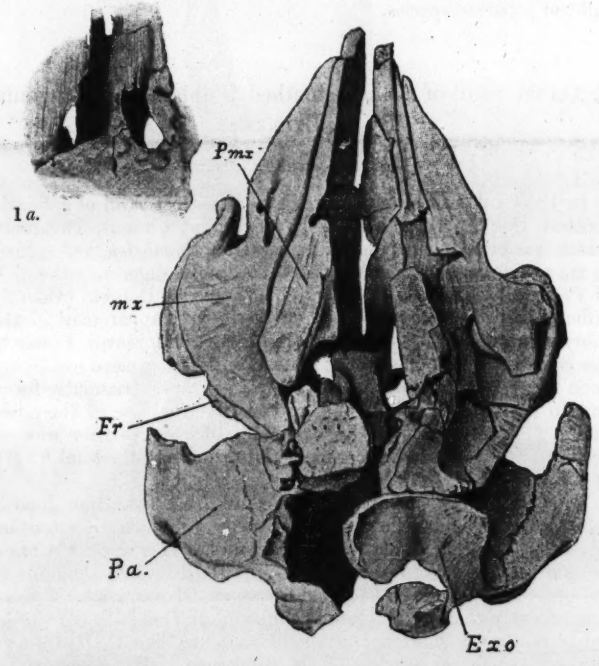
In 1893 I described and figured[1] an imperfect skull of a Shark-toothed Dolphin from a Tertiary deposit at Chubut, Patagonia, which was clearly generically distinct from *Squalodon*, and seemed to me to require a new name. I accordingly suggested the title of *Prosqualodon australis*. From *Squalodon* this Dolphin evidently differed in the smaller number of teeth, and apparently in the shorter and more laterally curved lower jaw. Moreover, I came to the conclusion that the nasals, instead of forming mere nodules of bone lying in depressions of the frontals, were of triangular form, and to a certain small extent roofed over the base of the nose-cavity. Unfortunately, the extremity of the rostrum was so broken as to preclude the possibility of estimating the total length of the skull.

This deficiency is supplied by a skull from the same deposit recently acquired by the British Museum, to which my attention has been directed by Mr. C. W. Andrews. This specimen has a general resemblance to the skulls of the short-beaked Dolphins of the present day, such as *Phocæna*, *Grampus*, *Globiceps*, &c. In size it apparently comes very close to the skull of *Pseudorca crassidens*, but is relatively shorter, and therefore more like that of *Cogia breviceps*, so far as proportion is concerned. It agrees in all respects with the type skull; and there is one detached tooth remaining, which is of the same Squalodont type as those of the latter. With the exception of a certain amount of damage to the region of the blow-hole, the new skull, in spite of numerous fractures, is comparatively but little imperfect on the upper surface. On the under surface the pterygoids, which afford such characteristic features in differentiating the skulls of the existing Dolphins, are wanting. Of the lower jaw only the greater portion of the right mandibular ramus is preserved.

[1] An. Mus. La Plata,—Pal. Arg. vol. ii. art. 2, p. 8, pl. iv. (1893).

The extreme shortness of the skull (only a very small portion of the tip of the rostrum being missing) indicates the wide difference of the genus from *Squalodon*; and we thus have evidence that the *Squalodontidæ*, like the *Delphinidæ*, were represented by a long-beaked and a short-beaked group. The question will therefore arise whether the two groups of the last-named family may not be independently derived from the two corresponding groups of the Squalodonts.

Fig. 1.



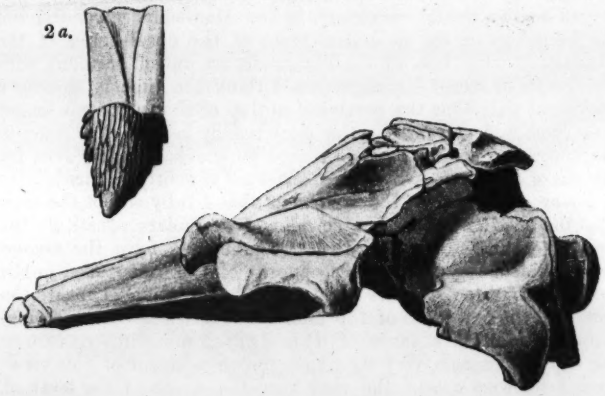
Upper surface of a skull of *Prosqualodon australis*, from the Tertiary deposits of Chubut, Patagonia. *Fr.*, frontal; *mx.*, maxilla; *Pmx.*, premaxilla; *Exo.*, supra-occipital; *Pa.*, parietal.
1 *a*. Narial region of specimen in the La Plata Museum.

Be this as it may, the general characters of the fossil skull are essentially those of modern Dolphins, asymmetry being but slightly developed, while the proximal extremities of the premaxillæ and maxillæ overlie and conceal the frontals to the same extent. The premaxillæ, although their vomerine borders are perhaps slightly imperfect distally, seem, however, to have roofed over the mesethmoid channel to a less degree than in existing Dolphins, thus

leaving in the dry skull the greater extent of the vomer exposed, very much as in *Cogia*. In life the exposed mesethmo-vomerine channel was doubtless occupied by a large mesethmoid cartilage. It is much to be regretted that the narial region of the British Museum specimen is imperfect, the nasal bones being wanting. I have therefore had reproduced (fig. 1 *a*, p. 920) this region from my original plate, from which it will be seen that the nasal bones, instead of being reduced to irregular nodules lying in depressions of the frontals, form a slight penthouse to the upper end of the blow-hole.

In my original paper I stated that the molariform teeth were double-rooted, like those of *Squalodon*; but a detached specimen (fig. 2 *a*, p. 921) shows that the two fangs have coalesced, although separated by a deep groove. And it appears that the same feature,

Fig. 2.



Lateral aspect of the specimen of *Prosqualodon australis* represented in fig. 1. 2 *a*. A molar tooth associated with the skull.

judging from the sockets, obtains in all the teeth of this type. Some of the hinder molars were, however, single-fanged; and the whole number of teeth did not apparently exceed ten or eleven pairs in each jaw, against the fifteen pairs of *Squalodon*. Whether the anterior teeth were of the slender incisiform type of the similarly situated teeth of *Squalodon* cannot be ascertained. The cusps on the molars are less developed than in the latter.

The new specimen accentuates the distinction of *Prosqualodon* from the last-named genus; and whereas in the structure of the nasals the South-American genus is the more generalized of the two, in the characters of the teeth it is the more specialized. It is worth mention that the retention of roofing nasals in *Prosqualodon* and in a second Patagonian genus, for which I have suggested the name *Argyrodelphis*, removes any difficulty, so far

as this part of the skull is concerned, in deriving the Whalebone from the Toothed Whales. But whether such is the true phylogeny may be left an open question; and I may add that, for several reasons, I do not propose on this occasion to discuss the geological age of the deposits from which *Prosqualodon* was obtained.

6. The Dental Formula of the Marsupial and Placental Carnivora. By R. Lydekker.

(Plate LXII.)

[Received October 21, 1899.]

Since the views expressed in the 'Study of Mammals'[1] with regard to the dental succession in the Mammalia generally, and the homology of the individual teeth of the cheek-series of the Marsupials with those of the Placentals, are out of harmony with the results of recent investigations, I think the time is ripe for a statement that I, as the surviving author of that work, no longer hold them. And I do this the more readily because it appears to me that some emendations in regard to the names employed for certain of the teeth of the cheek-series are urgently required.

I may commence by the statement that I fully accept the view that the milk-teeth *plus* the so-called true molars constitute the first, or original series, and that the premolars form the second series; this being precisely the opposite of the view taken in the work referred to[2]. Apart from other considerations, I regard the fact that the last tooth of the milk-molar series (as well as sometimes the tooth in advance of it) is always similar in structure to the true molars as a very strong argument in favour of this view. And I likewise accept the view that the whole of the teeth of modern Marsupials, with the exception of the single replacing pair in each jaw, belong to the first series.

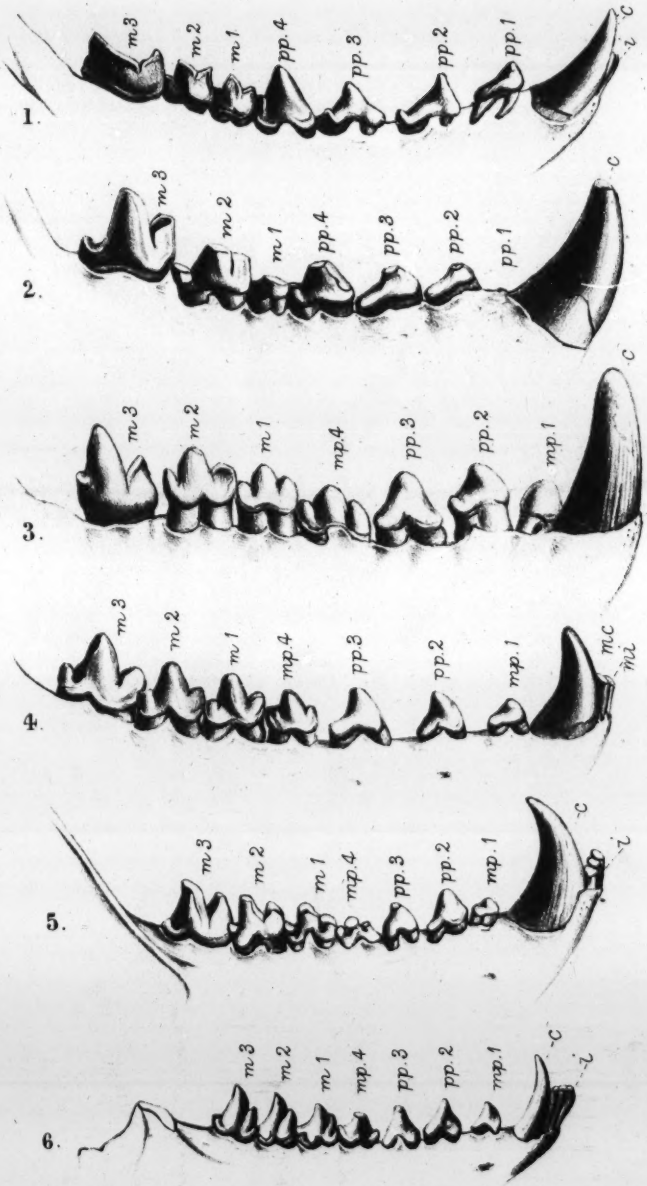
This being so, I come, without further preliminaries, to the consideration of the special subject of the present communication; that is to say, the serial homology of the individual cheek-teeth in the Marsupial and Placental Carnivora, and the dental formula that will best express this homology. It will simplify matters to confine our attention in the main to the teeth of the lower jaw, as what holds good for these will be likewise applicable in the case of those of the upper jaw.

To go no further back than the publication of his 'Odontography,' we find Sir R. Owen in that work[3] giving the lower dental formula of *Canis*, which may be regarded as typical for the

[1] Flower and Lydekker, 1891.

[2] I do not propose to take into consideration the evidence in favour of the occasional presence of an aborted successional series to the true molars.

[3] Page 475.



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LOWER TEETH OF PLACENTAL & MARSUPIAL CARNIVORA.

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Placental Carnivora, as *i.* 3, *c.* 1, *p.* 4, *m.* 3; while he gives that of the Marsupial *Thylacinus*[1] as *i.* 3, *c.* 1, *p.* 3, *m.* 4. Nothing is said as to any replacement in the dental series of the latter genus, or in Marsupials generally; the division of the cheek-series into premolars and molars having been apparently made solely from the form and characters of the teeth themselves. But it is important to recognize that the premolars and molars were regarded as being numerically just the reverse of one another in the Dog and the Thylacine; and that this view has been accepted by almost all subsequent writers till quite recently.

In 1867 Sir William Flower[2] carried matters one stage further by proving that, when any replacement at all occurred, only one pair of teeth in each jaw was changed in the modern Marsupials; this pair being the third of the cheek-series of seven. It was further argued that this replacing pair of teeth corresponded to the fourth cheek-tooth of the Dog, thus indicating that one premolar tooth (the first) was wanting in the Marsupial cheek-series, and hence suggesting that the full series in that group was originally *i.* 3, *c.* 1, *p.* 4, *m.* 4. It is, however, noteworthy that the three premolars of the Thylacine were still called *p.* 1, *p.* 2, and *p.* 3; and that the same notation was retained in the article "Mammalia" by the same writer in the 9th edition of the 'Encyclopædia Britannica.'

By the date of the issue of the third volume of his 'Anatomy of Vertebrates' (1868), Owen[3] had likewise recognized the fact that only a single pair of teeth were replaced in each jaw of the Marsupials; this, he said, "giving the extent of the theoretical deciduous series." From this it may be inferred that he did not accept the homology of the replacing tooth of the Marsupials with *p.* 4 of the Placental series.

But in a later part of the second volume (pp. 378 & 379) occurs the following very remarkable statement, which, although not altogether an exact solution of the problem, makes a very near approach to it:—"The observed phenomena of the development and change of the teeth led to the generalisation that the Marsupial differed from the Placental Diphyodont Mammals in having four true molars, i. e. *m.* 4 instead of *m.* 3; and also that they differed in having only three premolars, i. e. *p.* 3 instead of *p.* 4; the typical number of the grinding series, 7, being the same; and it was convenient for comparison to symbolise them accordingly. Since, however, there is reason to conclude that *m.* 1 in the Placental Diphyodonts is a continuation of the deciduous series of molars, which might be symbolised as *dm.* 5, and only becomes a permanent molar because there is no premolar developed above it, so we may regard the tooth marked *m.* 1 [that is to say, the fourth of the cheek-series] in *Thylacinus* as being an antecedent tooth of the deciduous series, rendered permanent by a like reason, the suppression of *p.* 4. In other words, that *m.* 1 in *Thylacinus* is the homologue of *dm.* 4 [the last milk-molar] of *Sus* [or *Canis*],

[1] *Ibid.* p. 377. [2] Phil. Trans. 1867, p. 631. [3] Page 285.

and that the true homologue of *pm.* 4 is not developed in the Marsupialia."

In this passage, then, the great anatomist recognizes, firstly, that the first true molar of Placentals belongs to the first series of teeth; and, secondly, that the fourth cheek-tooth of the Marsupials is a persistent last (fourth) milk-molar. And it is merely in order to obtain general recognition for these two important facts that the present paper is chiefly written.

The next amendment in the dental homology of the Marsupial and Placental Carnivora was made by Professor A. Gaudry [1], in 1878, who, struck by the resemblance between the teeth of the Creodont and Marsupial Carnivora, applied the same formula to both, thus making the lower dentition of *Thylacinus i.* 3, *c.* 1, *p.* 4, *m.* 3, or the same as that of *Hyænodon* and *Canis*. He then pointed out that although the Creodonts differed from *Thylacinus* and its allies by a complete dental replacement, yet the former likewise differed from modern land Carnivora by the circumstances that all their three true lower molars were of a carnassial type, and that they closely resembled the corresponding lower teeth of the Thylacine. No attempt was, however, made to show why the latter animal, in common with its kindred, should have four teeth of this same carnassial type.

In 1887 appeared a paper by Mr. O. Thomas [2], in which the replacing tooth of the Marsupials was definitely regarded as representing *p.* 4 of the Placental series, and was accordingly termed the fourth premolar; the second tooth of that series being regarded as missing in the modern Marsupials. In this communication the author suggested the use of the term "milk-premolars," in lieu of milk-molars. Mr. Thomas's nomenclature of the Marsupial series was adopted in the 'Study of Mammals.'

It was some years after the appearance of the paper last referred to that the researches of Messrs. Kükenthal and Röse afforded grounds for regarding all the teeth in advance of the replacing premolar of modern Marsupials as milk-teeth, and the identification of the true molar series as corresponding serially with the milk set rather than with the premolars. To these discoveries I need not refer further than to say that a useful summary of them is given by Professor Osborn in the 'American Naturalist' for 1893 [3].

I accordingly pass on to two papers by Señor Florentino Ameghino, in the course of which the remains of certain Marsupial-like Mammals from the Tertiaries of Patagonia are described and figured under the group-name of "Sparassodonta." In the first of these communications [4] the animals in question are said to be referable neither to the Carnivora Vera, the Creodontia, or the

[1] 'Les Enchaînements, etc.—Mammifères Tertiaires,' pp. 13–19.

[2] Phil. Trans. 1887, p. 447. Many of the views propounded here were modified in a paper published in the Ann. Mag. Nat. Hist. ser. 6, vol. ix. p. 308 (1892).

[3] Vol. xxvii. pp. 493–508.

[4] Bol. Ac. Cordoba, vol. xiii. pp. 259–452 (1894).

Dasyuridæ, although stated to present resemblances to each of these groups. Apparently in all cases the palate is devoid of the unossified vacuities characteristic of existing Marsupials. In many instances the upper incisors exceed the number occurring in modern Placentals, one of the genera (*Prothylacinus*) having the same incisive formula as in *Thylacinus*, namely $\frac{4}{3}$. The cheek-teeth (as shown in figs. 3, 5, and 6 of Plate LXII.) are also of a Marsupial type, the total number being seven, of which the last four are molariform. And in his first communication Señor Ameghino divides them according to the formula usually accepted for the Marsupialia; that is to say, into three premolars (*p.* 2, *p.* 3, and *p.* 4) and four molars. He also goes on to observe that while the milk-dentition is more reduced than in the Carnivora, it is less so than in the *Dasyuridæ*. The genus in which the reduction is carried to the greatest extent is the one named *Borhyæna* (Plate LXII. fig. 3), in which only the canine and the fourth cheek-tooth have vertical successors. On the other hand, in the other genera (e. g. *Prothylacinus*, fig. 5, and *Amphiproviverra*, fig. 6), both the second and third cheek-teeth, in addition to the canines, are thus replaced. In regard to the incisors there is no evidence.

In the drawing (Plate LXII.) I have had the lower jaws of the three genera mentioned figured alongside of those of the Creodont genera *Hyænodon* (fig. 1) and *Pterodon* (fig. 2) above, and of the Marsupial *Thylacinus* (fig. 4) below. And an inspection of these will show that, whereas the jaws shown in figs. 1 and 2 have but three molariform teeth, all the others have four. The general resemblance is, however, so striking between the whole series, that it is almost impossible to conceive that the seven cheek-teeth are not serially homologous with one another in the six genera.

And this idea has been developed in Señor Ameghino's second paper, published in the Society's 'Proceedings' for the present year[1]. Thus on page 556 he writes that he assigns to the teeth behind the canines the progressive numbers 1 to 7[2], since they are perfectly homologous in the Placentals and Marsupials, the only difference being that some teeth may belong to the first series in certain genera (*e. g.* the fourth in Marsupials) and to the second in others (*e. g.* the fourth in Placentals).

This view is in fact the one advanced by Owen, when he said that the fourth cheek-tooth of the Thylacine was a milk-molar rendered permanent by the suppression of its vertical successor. And looking at the number of forms described by Señor Ameghino which serve in some degree to connect the Creodontia with the *Dasyuridæ*, it appears to me, as already indicated, impossible to avoid accepting the above interpretation. The fourth cheek-tooth in the *Prothylacinidæ* (Sparassodonta) indisputably belongs to the

[1] *Supra*, pp. 555-571; I am not prepared to admit the Cretaceous age of some of the specimens described therein.

[2] This nomenclature had been long since proposed by Dr. H. Winge, Vidensk. Med. Kjöbenhavn, 1882, p. 65.

first series, as it does in *Thylacinus*; and we have now to ask, is there any evidence that this tooth ever had a successor in allied forms? The only instance with which I am acquainted where this question could possibly be answered in the affirmative is that of the Purbeck genus *Triconodon* (*Triacanthodon*), in which, as shown by Mr. Thomas [1], there are at least seven cheek-teeth, of which the fourth has a vertical successor. And it appears to me highly probable that we have in this genus an ancestral type of Marsupial in which all the first four cheek-teeth were replaced, as in the Creodonts. From this we pass to *Prothylacinus* and *Amphiproviverra* of the Patagonian Tertiaries, in which (if Señor Ameghino's observations are trustworthy) only the canine and the second and third cheek-teeth are replaced; to *Borhyæna*, in which replacement is restricted to the canine and third cheek-tooth; then to *Didelphys*, in which only the third cheek-tooth has a successor and that at a fairly advanced stage of life; and finally to *Thylacinus*, in which the same tooth is replaced *in utero*.

Accepting, then, the foregoing interpretation, namely that the seven lower cheek-teeth respectively met with in *Canis*, *Hyænodon*, *Prothylacinus*, and *Thylacinus* are serially homologous one with the other, I come to the main object of my paper, that is to say, to the formula we must adopt in order to indicate this. When I first considered the subject, I thought it would be necessary to adopt the plan proposed by Señor Ameghino, and to term the teeth respectively 1 to 7. If this view were adopted, it would, however, be necessary to use the term "cheek-teeth" in place of "molars," as the latter has a special restricted signification. Were we starting *de novo*, I think this would be the better course; but it is exceedingly inconvenient to interfere with the accepted use of familiar terms, and Mr. Thomas has suggested to me a way out of the difficulty which involves very little change.

If we agree to call the first four cheek-teeth of all the animals under consideration "premolars," as coming in advance of the "molars," which never have successors, then we may designate those that belong to the first series as "milk-premolars," and those of the second series as "permanent premolars," with the respective symbols of *mp.* and *pp.*

The adult dental formula of *Hyænodon* will then stand as follows, viz.:—

$$\frac{i.1\,.\,i.2\,.\,i.3}{i.1\,.\,i.2\,.\,i.3}\,\frac{c.1}{c.1}\,\frac{pp.1\,.\,pp.2\,.\,pp.3\,.\,pp.4}{pp.1\,.\,pp.2\,.\,pp.3\,.\,pp.4}\,\frac{m.1\,.\,m.2\,.\,m.3}{m.1\,.\,m.2\,.\,m.3}.$$

That of *Borhyæna* will be:—

$$\frac{?}{i.1\,.\,i.2\,.\,i.3}\,\frac{c.1}{c.1}\,\frac{mp.1\,.\,pp.2\,.\,pp.3\,.\,mp.4}{mp.1\,.\,pp.2\,.\,pp.3\,.\,mp.4}\,\frac{m.1\,.\,m.2\,.\,m.3}{m.1\,.\,m.2\,.\,m.3}.$$

[1] Phil. Trans. 1887, pl. xxvii. fig. 10.

Prothylacinus, on the other hand, will have the formula:—

$$\frac{mi.1\,.\,mi.2\,.\,mi.3\,.\,mi.4}{mi.1\,.\,mi.2\,.\,mi.3}-\frac{mc.1}{mc.1}-\frac{mp.1\,.\,pp.2\,.\,pp.3\,.\,mp.4}{mp.1\,.\,pp.2\,.\,pp.3\,.\,mp.4}-\frac{m.1\,.\,m.2\,.\,m.3}{m.1\,.\,m.2\,.\,m.3}.$$

Finally, in *Thylacinus* we shall have:—

$$\frac{mi.1\,.\,mi.2\,.\,mi.3\,.\,mi.4}{mi.1\,.\,mi.2\,.\,mi.3}-\frac{mc.1}{mc.1}-\frac{mp.1\,.\,mp.2\,.\,pp.3\,.\,mp.4}{mp.1\,.\,mp.2\,.\,pp.3\,.\,mp.4}-\frac{m.1\,.\,m.2\,.\,m.3}{m.1\,.\,m.2\,.\,m.3}.$$

In ordinary practice, however, when the number, rather than the successional homology, is the point to be elucidated, we may follow a modification of the practice now employed.

Hyænodon will remain as before, viz. $i.\frac{3}{3}$, $c.\frac{1}{1}$, $p.\frac{4}{4}$, $m.\frac{3}{3}$; and *Prothylacinus* and *Thylacinus* will be indicated by $i.\frac{4}{3}$, $c\frac{1}{1}$, $mp.$ & $p.\frac{4}{4}$, $m.\frac{3}{3}$. Possibly an emendation may be necessary in regard to the detailed formula of *Hyænodon*, for as the first cheek-tooth (as in almost all other Placentals) is not replaced, it may really be a persistent milk-premolar instead of a permanent premolar. Indeed the condition occurring in *Rhinoceros* suggests that such is probably the case.

In conclusion, I may depart so far from the subject indicated by the title of this paper as to express my opinion that the *Prothylacinidæ* (for I see no reason for regarding the "Sparassodonta" as representing more than a single family) are undoubtedly Marsupials, and that they are not very far removed from the *Dasyuridæ*, of which they may represent the ancestral type. They also appear to be related to the Creodontia, which are themselves in all probability the ancestors of both the modern Carnivora and Insectivora. The Creodonts, on this view, have retained a tooth-change which is lost in the modern Marsupials; and both groups may be derived from Mesozoic ancestors like *Triconodon* and *Amphitherium*, in which, as appears to be indicated in the first-named of these, there must have been a complete tooth-change. Evidence of such ancestry is afforded by the retention in *Myrmecobius* of the numerous true molars distinctive of some of the Mesozoic genera; while, as an abnormality, four true molars may occur in other modern Marsupials, such as *Didelphys*. If these Mesozoic mammals be rightly regarded as the common ancestors of both Creodonts and Dasyurids, it is more than doubtful if they can any longer be classed as "Marsupials," *sensu stricto*, for, in addition to possessing a complete tooth-change, it is, in the light of recent researches, quite possible, if indeed not probable, that they may have also been placentiferous.

I may add that the nomenclature proposed for the teeth of the Placental Carnivora will also be applicable to those of the other Placental orders.

EXPLANATION OF PLATE LXII.

Outer side of left ramus of lower jaws of Placental and Marsupial Carnivora.

Fig. 1. *Hyænodon leptorhynchus* (after Gaudry), p. 925.
2. *Pterodon dasyuroides* (after Gaudry), p. 925.
3. *Borhyæna fera* (after Ameghino), p. 925.
4. *Thylacinus cynocephalus*, p. 925.
5. *Prothylacinus patagonicus* (after Ameghino), p. 925.
6. *Amphiproviverra manzaniana* (after Ameghino), p. 925.

7. Field-notes on the Wood-Cat of Argentina (*Felis geoffroyi*).

By Ernest Gibson, F.Z.S.

[Received August 9, 1899.]

During the last twenty-five years I have had many opportunities of observing the habits of the "Gato Montés" (*Felis geoffroyi*) in this district, where it is not uncommon, frequenting the woods and grass-coverts. Too wild to approach poultry-yards (notwithstanding Azara's statement), it preys upon small rodents (*Cavia australis* and *Ctenomys brasiliensis*) and birds; and I greatly doubt the accusations made as to its attacking young lambs. That it can give a good account of itself with dogs is quite true; and it has been known to fly at man, or even a horseman, when brought to bay. I have seen it taken at night in one of the large and powerful traps employed for the Vizcacha (*Lagostomus trichodactylus*), and it even broke the chain and went through the surrounding circle of men like a small fiend, trap and all, and was never seen again; but it will not enter the usual box-trap so successful with our Fox (*Canis azaræ*).

The young Wood-cats are generally born in the early spring, and vary in number, as many as six having been reported, but the usual number is two or three. The breeding-place selected is a hollow tree, or a nest is made amongst the pampa-grass. A recently observed unusual site was a lonely abandoned "rancho." It is a curious trait that the Wood-cat will return to its usual den or lair after being hunted out by dogs or shot at; and that after a very short interval. In voice it can be very noisy, especially when wounded: one I shot inside a tree growled and roared most savagely.

The natural woods of the La Plata littoral terminate not far to the south of this locality (I write from 36° 20′ S. lat. on the sea-coast), *i. e.* before the Pampean formation is temporarily broken by the Sierras de Tandil. But the "Gato Montés" is still found as far as the 38th degree, and predominates over its congener, the Jungle or Grass-cat (*F. passerum*), the two being found in the there unwooded country. And the two species are associated on the treeless plains far inland—on the confines of Cordoba—though Azara only chronicled the latter in that locality (true, that was a hundred years ago!). Nevertheless, I have never heard of any hybrids; and I only wish to establish the fact that, while they

actually overlap in their ranges and the Wood-cat is to be found far out on the plains, the Grass-cat is unknown in the wooded or riverine districts.

The following are some measurements taken of two large males, the first having been killed as far back as 1873 and the second recently:—

	(1st)	(2nd)
Length, inclusive of tail	38 in.	37½ in.
Tail	12	12
Height before.....	15	13
Height behind	..	14½
Girth of abdomen	16	14
Girth of neck	11	9½
Length of head	6	
Width of head	5	

Weight of first (very thin) 13 lbs. I have heard of one that scaled 22 lbs.

November 28, 1899.

Dr. Henry Woodward, F.R.S., V.P., in the Chair.

Mr. Oldfield Thomas exhibited the skull of a Baboon recently obtained at Aden by Messrs. Percival and Dodson. It appeared to represent a new species allied to *Papio hamadryas*, but distinguished by its small size, the row of upper cheek-teeth being only 41·5 mm. in length. This species was proposed to be named *Papio arabicus*.

Mr. W. Saville-Kent, F.L.S., F.Z.S., stated that he had devoted considerable attention since the meeting of the last session to the subject of trichromatic or three-colour photography as applied to the correct colour-registration of Zoological and Botanical subjects. With the aid of the lantern he submitted a series of examples upon which he had successfully experimented. These included various species of tropical butterflies, orchids, fishes, lizards, and birds. Among the slides displayed, that of a peacock's feather, in which the characteristic tints were reproduced with marked fidelity, was particularly referred to as a successful demonstration of the capabilities of the system. Gold and Silver Carp, Cuckoo Wrasses (*Labrus mixtus*), and other marine species, taken by Mr. Saville-Kent at the Plymouth Zoological Station, yielded appropriate illustrations of the process as applied to the colour-registration of the more brilliant but notably evanescent hues of fishes. In the bird-section, especial prominence was given to the correct colour-portrayal of the gaily plumaged Australian finches *Poephila gouldi* and *P. mirabilis*. These were

represented as lantern-transparencies prepared from photographs of artistically preserved specimens, and also from the replica of a water-colour drawing of a group of these birds executed by Mr. J. G. Keulemans from living examples.

Mr. Saville-Kent explained that all these photographs had been taken by him with the Sanger-Shepherd colour-screens, of which he exhibited a set, in conjunction with the Cadett "Lightning Spectrum-plate." These screens represented the three primary spectrum colours, red, green, and blue-violet, as enunciated by the late Prof. Clerk-Maxwell, and a separate negative of the subject had to be taken through each respective screen. The transparent positives prepared from these negatives were stained with tints complementary to those through which they were severally taken. That was—the positive resulting from the red-screen negative was stained blue or minus red; that from the green screen, red or minus green; and that produced from the blue-violet screen, yellow or minus blue. Due care being exercised in obtaining the right tint-gradation, and the three stained positives being then superimposed in precise register, an optically perfect presentment or counterfeit of the original subject was mechanically produced. The special method of developing and staining the positives exhibited was, as in the case of the production of suitable colour-screens, associated with the name of Mr. Sanger Shepherd, with whom Mr. Saville-Kent had been working in collaboration.

It was recommended, for the acquirement of perfect registration, that all three of the respective negatives should be taken on a single plate in conjunction with a specially constructed multiple back, of which a sample was exhibited. This, however, was not absolutely necessary. It was competent, in fact, for anyone possessing an ordinary camera to secure correct colour-replicas of desirable objects, using only in conjunction with his instrument the Cadett spectrum-plates and colour-screens referred to. As an illustration of this fact, Mr. Saville-Kent explained that the Peacock's feather, and several other subjects exhibited that evening, had been taken by him with a large-sized Kodak camera, across the lens of which he had simply slung, with the aid of elastic bands, consecutive sections of his multiple-back screen.

The negatives taken for the production of these lantern-transparencies were also available for three-colour printing or process work. In conjunction more especially with such a perfected machine as the newly introduced Orloff Colour-printing Press, there was evidently a wide field thrown open for the cheaper reproduction, by printing methods, of Zoological and Botanical subjects in their correct natural colours. For lantern demonstration, at any rate, the Sanger-Shepherd process as illustrated by him that evening would, Mr. Saville-Kent anticipated, strongly recommend itself to adoption by the many naturalists who had hitherto employed their cameras for the delineation in monochrome only of the subjects of their studies. In the instances, more especially, of the brilliant but fleeting tints of reptiles, fishes,

and marine subjects, as also in those of the tegumentary tissues and appendages of birds, this method of colour-registration would be of invaluable aid to the working artist, who having possession of a correctly prepared transparency might utilize it at his leisure for the elaboration of a finished painting. The successful application of the same process to the duplication, as lantern-transparencies, of coloured figures of zoological subjects had been demonstrated by the example of the pictures of the Gouldian Finches submitted to the meeting. In a like manner, coloured illustrations from other more rare and costly zoological works could be correctly reproduced.

The following papers were read :—

1. General Account of an Expedition to the Gambia Colony and Protectorate in 1898–99. By J. S. Budgett, F.Z.S.

[Received November 28, 1899.]

I propose to give a short general account of an expedition recently made by me, under instructions from the Council of this Society, to the river Gambia. This expedition had for its object the general study of the vertebrate fauna of the Gambia, and especially the investigation of the habits of *Protopterus* and *Polypterus*.

The river Gambia lies between the 13th and 14th parallels of North latitude. It flows due west through country which, lying about 100 miles to the north of the equatorial forest-region, is nowhere densely wooded but mostly covered with a somewhat sparse vegetation consisting largely of leguminous trees interspersed with gigantic baobabs (*Adansonia digitata*), the African mahogany (*Kaya senegalensis*), figs and sycamores.

Extensive open plains, which in the rainy season become flooded, border this river along the greater part of its course, while at a very variable distance from the river-bank low hills of dark red conglomerate rise, often abruptly, and occasionally in steep cliffs, to form level plateaux, which in the upper river may be 200 feet high.

The river-bank itself is clothed throughout the year with a rich luxuriant vegetation extending usually about 100 yards from the water's edge. Though here the trees and creepers remain green the year round, yet away from the river the trees lose their foliage in the dry season as completely almost as our own trees in winter.

From the mouth of this river to the country just below Nianimaru, the river is shut in by an almost impenetrable wall of mangroves, sometimes 30 feet in height. Above this point the river, though

tidal, is perfectly fresh. The tides in the dry season make themselves felt for over 200 miles up the river, in fact to the end of navigable water, where there is about a foot rise.

The dry season extends from November to May. Tornadoes usually begin in June, while during July, August, and September there is a total rainfall of about 50 inches. During these months, though the tides make themselves felt, yet there is no change in the direction of the flow, while in August there runs a steady current of about 3 or 4 miles an hour.

In passing up the river the first place of interest is the old Fort James, which was formerly the port of export of the Gambia for the black-ivory trade. It is now being slowly washed away.

About 20 miles further up, the Vintang creek joins the Gambia, and at the junction of the two streams is the village of Vintang; it is seldom that a purely native village is seen at the water's edge, as they are usually on higher ground a mile or so from the river. If there are any tall trees in these villages, they are sure to be the nesting-places of Pelicans and Marabou-birds, which in the neighbourhood of the villages are strictly preserved. The vast flocks of these birds and also of the Balearic Crane are a great feature in the lower river, where there is little else to be seen but continual walls of mangroves, though now and again the monotony is broken by the passage of a native canoe or some trading cutter; but further up the variety of the vegetation is much greater.

Of particular interest to myself were patches of a Pandanus growing in the swampy ground at the river-side. The native name of this was Fang jani, which means "It burns itself." It certainly looked as though it deserved this name, for wherever it was seen a portion of every patch was charred with fire, and it was not easy to imagine how this could have been set alight by an external agency.

The great trading station on the Upper Gambia is M'Carthy's Island. To this place the trading cutters bring their cargoes of ground-nuts, the fruit of the plant *Arachis hypogæa*, to be shipped to Europe by the Ocean steamers which make their way up to this island.

On M'Carthy's Island there are two trading establishments or 'factories' as they are termed, and the remains of an ancient military settlement, consisting of Government House, Officers' quarters, and Barracks, formerly occupied by a detachment of the West India Regiment, which was withdrawn about 1870. The Government House alone of these buildings has been kept in repair; and here I established myself in company with Mr. Wainewright, the Commissioner of the district, who, though usually travelling about the district, yet spends a considerable portion of his time here as Governor of the island. I stayed on M'Carthy's Island about one third of my time. To the Governor of the Colony, Sir Robert Llewellyn, I am indebted for allowing me the free use of the Colonial steamer, 'Mansah Kilah,' and also for much hospitality. To Mr. Wainewright, the Travelling Commissioner in the M'Carthy's

Island district, I am greatly indebted for allowing me the use of a portion of the Government House at M'Carthy's Island, and also for the use of his huts in the main towns of his district. Very soon after my arrival at my headquarters, I made a tour through the district with the Commissioner to get some idea of the kind of country that surrounded me.

We started from Nianimaru, which was subsequently made my second headquarters, and where I spent even more time than at M'Carthy's. The chief interest in this tour lay in the people themselves, the country we travelled through not being of great interest from the point of view of its scenery.

Travelling was not difficult, as porters were plentiful, and were employed from one village to the next at the rate of 3*d.* a man, if the distance was not more than 5 miles. At the important towns a court was held, and a stay was made of two days. The courts were held in the open, the chief, the head-man of the town, and the people all sitting round the Commissioner's chair.

There was plenty of time for shooting and no need to carry much in the way of provisions. The bag usually consisted of Bush-fowl and the Barbary Quail, *Pterocles quadricincta*, Guinea-hen, *Œdicnemus*, various Spur-winged Plovers, especially *Lobivanellus senegalus* and *Hoplopterus spinosus*, also Doves and Pigeons as many as were required. The finest of these, as game, was the Green Pigeon (*Treron calva*), which is never seen to approach the ground, being especially fond of the fruit of the fig-tree.

The commonest birds around us, which were not shot for the pot, were numbers of four species of *Coracias*, a *Centropus* known as the "foolish bird" from its fearless habits and its call, which resembles a soft laugh, several species of *Bucerotidæ*, generally seen flying clumsily from tree to tree in small flocks; while overhead hovered large flocks of Bee-eaters (*Merops nubicus*), swallow-like in flight and song.

Other common birds everywhere seen in large flocks were the Metallic Starlings (*Lamprocolius auratus* and *L. caudatus*); Wood-Hoopoes (*Irrisor senegalensis*) seen in smaller flocks; while the commonest solitary birds were the Long-tailed Shrike (*Corvinella corvina*) and a species of Drongo (*Dicrurus assimilis*). The bushes of course swarmed with *Ploceidæ* and *Nectariniidæ*.

It being the beginning of the dry season, the grass was everywhere yet high, and it was out of the question to do any mammal-shooting; the only mammals visible were Climbing Squirrels and Monkeys. Burrows of *Orycteropus* were seen, though the animal does not appear to be very common in this region.

The towns visited during this tour were mostly far from the river and were taken in the order Nianimaru, Sukuta, Kaihai, Demfai, Tabanani, Sami, Koreantab, and back to M'Carthy's Island.

Near Kaihai there were news of a Giraffe having been seen, but they appear to be extremely rare in these parts. I heard indirectly that there were two in captivity at Kaies on the Senegal river.

Having returned to M'Carthy's Island on December 5, I devoted myself again to fishing and catching *Polypterus*. I found that all the specimens of *Polypterus lapradii* had already returned to the river from the swamps, where they come up to spawn in the wet season. However, large numbers of the young of *Polypterus senegalus* could still be caught by damming up the swamp-outlets.

This is a favourite way of fishing with the natives. They make dams across the creeks at short intervals, and then leave them in connection with each other for some days. Then damming up the connections, they bale out the water from the lowest compartment, collect the fishes, and proceed to the next compartment.

Very much more difficult is it to catch the *Polypteri* in the river. Nets which were very successful with other river fishes, failed utterly with *Polypterus*. The seine-net and trammel were given up, and the native cast-net was used with better success. The results of weeks of patient work were not encouraging however, and I gradually realized that the time to catch *Polypterus* was during the rainy season, when it had betaken itself to the flooded lands.

However, during these fishing days at Nianimaru, many interesting fishes were caught, and most of the common small Passerine birds were skinned. Moreover, this fishing was not without its dangers and excitement, as a look-out had ever to be kept for Hippopotami which swarmed in all the creeks. Moreover, frequently in the morning, when the trammel-net was examined, a Crocodile (*Crocodilus cataphractus*) or a Sawfish (*Pristis perotteti*) had to be slain. Several specimens of the latter were thus caught up as far as M'Carthy's Island, some of them measuring 9 feet in length.

Fly-fishing was tried without success. The line and hook were used more by the natives than myself. The trammel was found to be the best kind of net to use for the *Mormyridæ*, which were seldom caught in other ways. The Mormyrids apparently keep to the bottom of the river, and were seldom taken in the seine near shore.

It was noticed that a very large proportion of the fishes caught in this river were brilliantly coloured red in the ventral posterior portion of the body. Of fishes I believe 40 species were obtained, including 2 Selachians, *Protopterus annectens*, *Polypterus lapradii* and *P. senegalus*, 8 species of Siluroids and 7 Mormyridæ, and 18 others belonging to various groups. Most of the fish were tried as food, but there was only one that was really good eating: this was, I believe, a grey mullet and was taken far up the river.

Often the creeks in which the cast-net was thrown were very narrow, and the canoe slid silently amongst the most luxuriant vegetation abounding with Bee-eaters and Flycatchers. Altogether representatives of 108 species of birds were shot, measured, and described; but skins were made only of the smaller birds, of which examples of 52 species were obtained, belonging to 23 families.

With Dr. Gadow's assistance, most of these have been identified. Of the *Upupidæ*, in addition to the gregarious *Irrisor* already

mentioned, several specimens of *Scoptelus aterrimus* were seen and a skin of a male preserved.

On April 4 I took my two fishermen, my cook, and canoe up to a small village in the Kunchow creek called Alimaka, and there had some huts built. At this place again the trammel, the seine, and the cast-net were worked with hope of obtaining numbers of *Polypterus*. As a rule in the afternoon I went out to shoot, and found it a fair place for game.

During the fortnight thus spent at Alimaka, only six *Polypteri* were caught. There were caught also in this creek several specimens of *Gymnarchus niloticus* and some fine specimens of a freshwater Turtle, *Cyclanorbis senegalensis*. Lions were heard here frequently, and Leopards were seen, but at neither did I get a chance of a shot.

On April 20 two English gentlemen and a Frenchman arrived at M'Carthy's Island, on their way to some supposed gold-mines about 300 miles to the east of M'Carthy's Island. I accompanied them a short distance beyond the eastward British frontier to the town of Netebulu; the river is not navigable beyond that point.

Netebulu is an important native town, where a powerful chief named Sandian had his castle and harem. Here we stayed several days as the guests of the chief, and then I parted from the gold expedition, and made my way back overland to M'Carthy's Island, staying on the way a week at Koina.

About 50 miles above M'Carthy's Island the river-banks become high and precipitous, the country around being composed of high plateaux intercepted by valleys. Frequently, however, the edges of the plateaux retreat from the river-bank a mile or so, surrounding wide plains, where one could be fairly certain of finding game.

Along the steep cliffs of the river-bank, vast numbers of Dogfaced Baboons (*Cynocephalus babuin*) might be seen wending their way. Sometimes the cliffs extended so far along the river-side that the Antelope were forced to come down to drink at certain places, and here the ground would be covered with their spoor.

April and May are the best months for big-game shooting. At Koina, large herds of Tankong (*Damaliscus korrigum*) were seen almost every day. Several were shot and a complete skin was made, which, however, suffered severely from the attacks of dogs and insects before it reached England. These herds were composed of males, females, and young of every age. The largest males seemed to lead the herd, though fine males mingled with the females and young as they daily made their way back in long procession from the river-banks to the higher lands.

Large herds were also seen of *Hippotragus equinus*, the Roan Antelope, or Dakoio as the natives call it, but this species was not so plentiful as the Tankong in these parts. A herd of Elands (*Oreas derbianus*) are believed to have been seen in the distance, and I was presented with a skull taken by Mr. Wainewright from a carcass floating down the river.

In the open plains, where clumps of tall dead grass were shaded by a few trees, one might generally count on starting a Konkotong (*Cobus kob*), some Gazelles, or a Harnessed Antelope. The smaller solitary Antelopes were usually found in pairs. Enquiries were instituted everywhere as to the existence in this region of a Zebra, but I could hear nothing of it.

The horns either collected by me or from the natives included those of 9 species:—*Bubalis major*, *Damaliscus korrigum*, *Cobus unctuosus*, *Cobus kob*, *Cervicapra redunca*, *Hippotragus equinus*, *Tragelaphus scriptus*, a second species of *Tragelaphus* not yet determined, and *Oreas derbianus*.

Buffaloes were said to be common on Deer Island, but they were not seen by me, though horns of two forms were obtained from natives.

On the way back, a cutter was taken from Fatotenda to M'Carthy's Island, and after a few days spent at the Government House attending to my collections, and my living fishes and reptiles, I paid a final visit to Nianimaru. During this time, being the latter part of May, the rainy season began and the swampy places became filled with water. The Frogs began to spawn, and several series of stages in development of the different forms were preserved.

Here I first obtained free swimming *Protopterus* with ripe ovaries: examples of 8 Frogs, 3 Chelonians, 5 Lacertilia, and 9 Ophidia, including a *Typhlops*, were also collected about this time.

Returning to M'Carthy's Island, it was found that a number of *Polypterus lapradii* which had been kept in a pool connected with the river in the hope of getting them to spawn had been set free by the rising river. However, during the latter part of June and July a large number of *Polypterus* of both species were obtained, the females of which were crowded with ripe eggs. Artificial fertilization was tried with these, without success. Many were kept in confinement, and some, of which a pair are now exhibited, were successfully brought alive to England.

About the 10th of July, in the same swamp where these fishes were obtained, several nests of eggs were found. These eggs coincided in measurement exactly with the ovarian eggs of *Polypterus*. The young larvæ possessed cement-organs on the front of the head so characteristic of Ganoid larvæ; and other characters led me to assume that they were the young of *Polypterus*. None were reared beyond the larval state, and their identity could not well be established. However, having stayed on the Gambia three months longer than I had intended, and having a number of healthy *Polypteri* full of spawn, I decided to return home.

Just a day or so before leaving M'Carthy's Island I obtained eggs of *Protopterus*. These were watched through the early stages of segmentation, but the young could not be reared. On July 25 I left M'Carthy's Island and returned to England.

Several *Polypteri* and *Protopteri*, 12 young *Crocodilus cata-*

phractus, a Python, 3 *Cyclanorbis senegalensis*, 2 Hinged Tortoises, some Chameleons, and a Serval Cat were brought home alive.

Since my return to England, I have definitely decided that the eggs and larvæ obtained are not those of *Polypterus*. I have, however, I believe, learned enough about the habits of *Polypterus* to encourage me to make a second attempt next year to obtain the developmental stages.

In conclusion, I wish to thank the Society for lending me influence and support, without which the little that has been done by this expedition could not have been accomplished.

2. A Note on the Hatching-stage of the Pagurine Land-crabs. By L. A. Borradaile, M.A., F.Z.S., Lecturer in Natural Sciences of Selwyn College, Cambridge.

[Received October 12, 1899.]

The life-history of the Land-crabs of the family Cœnobitidæ is one to which considerable interest attaches, and of which, at present, nothing appears to be known. The family comprises the genera *Birgus* and *Cœnobita*, the robber- or coconut-crab and the land hermit-crabs, all of which have given up a sea life for one on land. It need hardly be remarked that changes in habitat, particularly from sea to land or fresh water, have frequently necessitated the suppression of larval stages in the life-history. Among Crustaceans the instances of the cray-fishes, the ditch-prawn (*Palæmonetes varians*), the freshwater crabs (*Potamon*), and at least one species of land-crab (*Gecarcinus*) come at once to mind. The possibility was thus suggested that the land-pagurines might also have lost the whole or a part of their larval life, and leave the egg in something like the adult condition. On the other hand, it had to be borne in mind that some species of land-crabs and all the strand-crabs (*Ocypoda*, &c.) retain the habit of setting free zoœa-larvæ in the sea, where they pass through their earlier stages.

It was probably with these considerations in his mind that von Willemoës-Suhm, when, in October 1874, the 'Challenger' arrived at Zamboanga in the Philippine Islands, wished to investigate the development of the robber-crab from the egg. Unfortunately the time of year rendered it impossible for him to do this, but he was told by an "intelligent native" that the young were born resembling the parent. This statement has since been accepted in a tentative manner by certain text-books, in spite of the fact that the small size of the eggs (and, indeed, of the female genital opening) made it improbable that the development was a direct one, depending on food-yolk. As for the statement of the

native, it is only what was to be expected. A "native," being unfamiliar with the idea of a metamorphosis, will always give the same answer to any question on the subject, namely that the young are born exactly like the adult—but very small.

All doubt on this point has, however, now been removed by the discovery by Dr. A. Willey of a female *Birgus* on the rocks at the brink of the sea at Lifu in the Loyalty Islands.

The abdomen of this specimen was covered with hatching zoæas which were being washed off into the water. The time of the year was the month of January [1].

With regard to the genus *Cœnobita*, I have myself recently taken specimens of two species (*C. rugosus* and *C. perlatus*) in Ceylon and the island of Minikoi in the months of May and June, bearing zoæas. The animals were taken on the stretch of wet sand just above the waves. The catches of the tow-net in the island of Minikoi not having yet been examined for specimens of the zoæa of *Cœnobita*, the possibility is not completely excluded that the larvæ may undergo the whole or a part of their development within the shell of the mother, which is always wet with salt water. The larvæ, however, did not, on a cursory examination, give any indication to justify such an assumption, and when placed in sea-water lived for a short time and showed powers of swimming in a lively manner. An attempt to rear them unfortunately failed, but this was only to be expected in view of the known difficulty of the operation. It is perhaps worth noticing that the above two species of *Cœnobita* are those whose habits keep them nearest to the sea. If an abbreviated development is to be found in the genus, it would more probably occur in forms such as *C. spinosus* which live at a considerable distance from, or at least a considerable height above, the sea.

From the observations just recorded, it is clear that the early stages of the development of the *Cœnobitidæ* present no very remarkable features. It may be presumed that later stages follow the ordinary course. The only points of interest remaining for investigation are the assumption of the adult form by *Birgus* and the transition from sea to land, which we may hope to have described by some future traveller in the Pacific Ocean.

[1] The present writer is under great obligation to Dr. Willey for handing over to him a number of these zoæas, which will be described and figured in Part V. of Dr. Willey's "Zoological Results" now being published by the Cambridge University Press. It is intended also to publish an account of the larvæ of *Cœnobita*.

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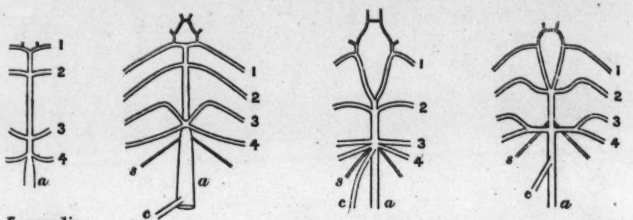
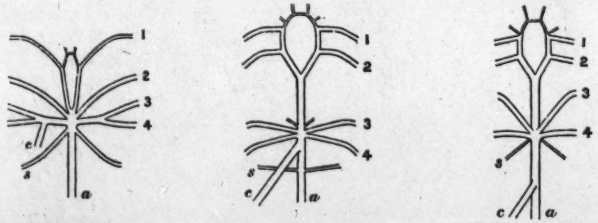
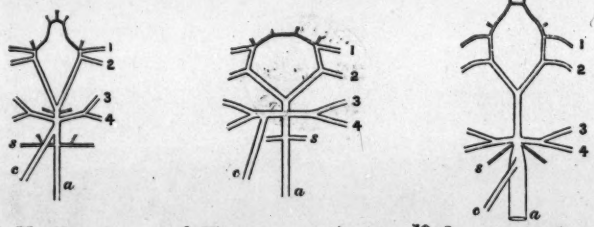


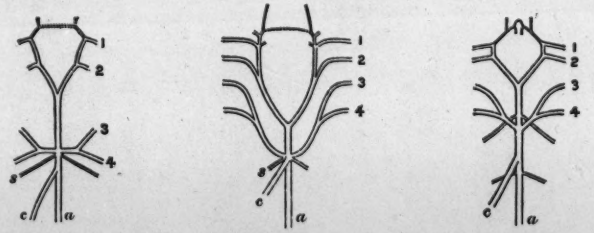
1. Engraulis encrasicholus *2. Clupea harengus* *3. Ammodytes lanceolatus.* *4. Megaleps cyprinoides.*



5. Balistes aculeatus. *6. Scomber scombrus.* *7. Salmo salar.*



8. Mugil capito. *9. Hippoglossus vulgaris.* *10. Osmerus eperlanus.*



11. Albula conorhynchus. *12. Malapterurus electricus.* *13. Cyprinus carpio.*

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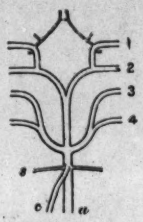
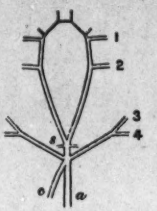
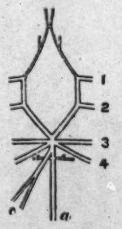


14. Cobitis taenia.



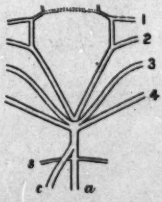
15. Esox lucius

16. Anguilla vulgaris.



17. Labrax lupus.

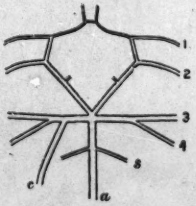
18. Liocassis longirostris



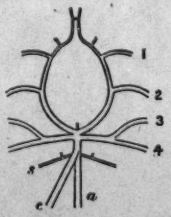
19. Callichthys littoralis.

20. Clarias magur.

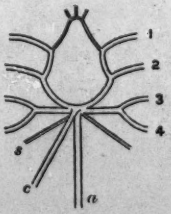
21. Perca fluviatilis.



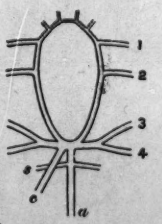
22. Zeus faber.



23. Anarrhichas lupus.



24. Labrus maculatus.



25. Exocoetus brachysoma.

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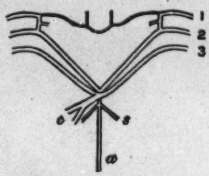
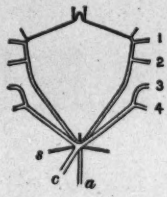
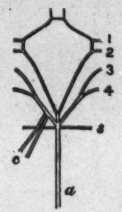


26. Lophius piscatorius.



27. Cottus scorpio.



28. Trigla cuculus.

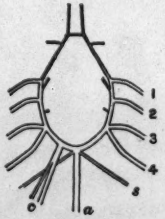
29. Cyclopterus lumpus.

30. Fistularia tabaccaria.

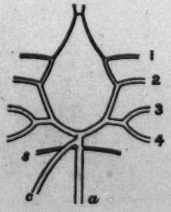
31. Saccobranchus fossilis.

32. Silurus glanis.

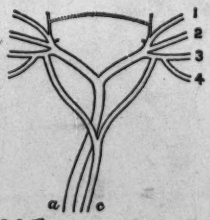
33. Syngnathus acus.



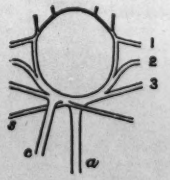
34. Gadus aeglefinus.



35. Blennius pholis.



36. Orthagoriscus truncatus.



37. Tetrodon palembangensis.

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EFFERENT BRANCHIAL VESSELS
OF TELEOSTEAN FISHES.

3. On the Relations of the Efferent Branchial Blood-vessels to the "Circulus Cephalicus" in Teleostean Fishes. By W. G. Ridewood, D.Sc., F.L.S., Lecturer on Biology at St. Mary's Hospital Medical School.

[Received August 1, 1899.]

(Plates LXIII.–LXV.)

Introduction.

When engaged in dissecting a Herring some years ago, I was struck by the fact that the four efferent branchial vessels all reached a median vessel which was continuous behind with the dorsal aorta, and that the circulus cephalicus was situated anteriorly to the first pair of vessels. This condition was so totally different from what I knew to be the arrangement of the vessels in the Cod, that I examined the same parts in a third form, the Salmon, and here found a condition intermediate between the two preceding. The results appeared to warrant a further inquiry, and the present investigation was undertaken with a view to ascertaining what are the commonest, and what the extreme modifications of the efferent branchial arteries to be met with among Teleostean fishes.

The greater part of the work was done during the summer vacation of 1892 at the Marine Laboratory of St. Andrews, Scotland; but owing to the difficulty of making the series of fishes thoroughly representative, the investigation has been protracted over a period of seven years. Late, however, as it may now appear, I take the opportunity of expressing my warmest thanks to Prof. W. C. McIntosh, M.D., F.R.S., for his kindness in placing at my disposal for six weeks during the summer of 1892 all the facilities that are afforded by the St. Andrews Laboratory for the procuring and injecting of the indigenous fishes. I have also to thank Prof. G. B. Howes, LL.D., F.R.S., of the Royal College of Science, London, for specimens of *Perca*, *Trachinus*, *Lophius*, *Fistularia*, *Motella*, *Ammodytes*, *Silurus*, *Exocœtus*, *Esox*, *Albula*, *Megalops*, *Chirocentrus*, and *Hippocampus*, and Mr. G. A. Boulenger, F.R.S., of the Natural History Museum, for specimens of *Corvina*, *Equula*, *Gobius*, *Sphyræna*, *Hemichromis*, *Clarias*, *Saccobranchus*, *Malapterurus*, *Callichthys*, *Scopelus*, *Cobitis*, *Marcusenius*, *Balistes*, *Tetrodon*, and *Orthagoriscus*.

The series of forms examined includes 61 species belonging to 57 genera.

List of Species examined.

ACANTHOPTERYGII.

Percidæ.
- Perca fluviatilis.
- Labrax lupus.

Mullidæ.
- Mullus barbatus.

Sciænidæ.
- Corvina nigra.

Carangidæ.
- Equula edentula.

Cyttidæ.
- Zeus faber.

Scombridæ.
- Scomber scombrus.

Trachinidæ.
- Trachinus draco.

Pediculati.
- Lophius piscatorius.

Cottidæ.
- Cottus scorpio.
- Trigla gurnardus.
- Trigla cuculus.

Discoboli.
- Cyclopterus lumpus.

Gobiidæ.
- Gobius giuris.

Blenniidæ.
- Anarrhichas lupus.
- Blennius pholis.
- Centronotus gunellus.
- Zoarces viviparus.

Sphyrænidæ.
- Sphyræna vulgaris.

Mugilidæ.
- Mugil capito.

Gastrosteidæ.
- Gastrosteus spinachia.

Fistulariidæ.
- Fistularia tabaccaria.

Gobiesocidæ.
- Lepadogaster gouanii.

PHARYNGOGNATHI.

Labridæ.
- Labrus maculatus.

Chromides.
- Hemichromis fasciatus.

ANACANTHINI.

Gadidæ.
- Gadus æglefinus.
- Molva vulgaris.
- Motella tricirrhata.

Ophidiidæ.
- Ammodytes lanceolatus.
- Ammodytes tobianus.

Pleuronectidæ.
- Hippoglossus vulgaris.
- Pleuronectes flesus.

PHYSOSTOMI.

Siluridæ.
- Clarias magur.
- Saccobranchus fossilis.
- Silurus glanis.
- Liocassis longirostris.
- Malapterurus electricus.
- Callichthys littoralis.

Scopelidæ.
- Scopelus boops.

Cyprinidæ.
- Cyprinus carpio.
- Hypophthalmichthys nobilis.
- Cobitis tænia.

Scombresocidæ.
- Exocœtus brachysoma.

Esocidæ.
- Esox lucius.

Mormyridæ.
- Marcusenius plagiostoma.

Salmonidæ.
- Salmo salar.
- Salmo trutta.
- Osmerus eperlanus.
- Coregonus oxyrhynchus.

Clupeidæ.
- Engraulis encrasicholus.
- Clupea harengus.
- Clupea sprattus.
- Albula conorhynchus.
- Megalops cyprinoides.

Chirocentridæ.
- Chirocentrus dorab.

Murænidæ.
- Anguilla vulgaris.

LOPHOBRANCHII.

Syngnathidæ.
- Syngnathus acus.
- Hippocampus guttulatus

PLECTOGNATHI.

Sclerodermi.
- Balistes aculeatus.

Gymnodontes.
- Tetrodon palembangensis.
- Orthagoriscus truncatus.

Literature.

On searching through the literature of the subject, one cannot fail to be struck by the fact that the arterial system of Teleostean fishes has been very greatly neglected, and the disposition of the efferent branchial vessels particularly so. Meckel and Hyrtl appear to have been the only anatomists to undertake anything like a systematic study of these latter. Meckel in 1831 (**14.** p. 192) pointed out that the mesial ends of the third and fourth efferent branchial vessels are usually close together, and may unite with one another before joining the aorta; and he furnished a few observations on the efferent branchial system of *Gadus*, *Trigla*, *Perca*, *Pleuronectes*, *Lophius*, and *Muræna*. Seven years later Hyrtl (**7**) gave a table showing the proportions of the circulus cephalicus in fourteen species of Teleosteans, supplemented by a considerable amount of information concerning the vessels associated with the circulus, and good figures of the efferent branchial system of *Perca*, *Gadus*, and *Tinca*.

Stannius in 1849 (**23.** pl. v.) published some fairly reliable figures of the efferent vessels of *Cyclopterus*, *Gadus*, *Salmo*, and *Scomber*, but the blood-vessels were only introduced into his figures to act as landmarks for the recognition of the sympathetic nerves, and must not be treated too critically. In his 'Handbuch' of 1854, however (**24.** p. 242), he made reference to the fact that the circulus cephalicus is wide in *Gadus* and *Lota*, where all the efferent branchial vessels open into it, whereas it is narrow in *Scomber* and *Salmo*, in which genera the last two open directly into the aorta. The only other information on the subject is that conveyed by the figures of the Carp by Duverney (**6.** pl. ix. figs. 17 and 18), the Perch by Laurillard in Cuvier's 'Histoire Nat. des Poissons' (**5.** pl. vii. fig. 1), the Cod by Müller (**16.** pl. iii. fig. 13), the Trout by Vogt (**1.** pl. L. fig. 2), the Pike by Maurer (**13.** pl. xi. fig. 1), the Cod by T. J. Parker (**20.** p. 117), and the contributions by Hyrtl on *Heterotis* (**9**), *Gymnarchus* (**11**), *Chanos* (**12**), and other genera.

General Part.

As may be gathered from the title, the observations recorded in this paper concern the efferent branchial vessels and the vessels formed by their confluence. The cœliaco-mesenteric and subclavian arteries usually arise in relation with the hinder part of the circulus cephalicus, or with that part of the aorta which receives the third and fourth efferent branchial vessels. The positions of these arteries are indicated in the figures, and occasional references are made to them in the text; but the investigation does not profess to deal exhaustively with these vessels, nor with the hyoidean, anterior carotid and posterior carotid arteries, which also are associated with the circulus cephalicus.

The dotted lines in the figures signify that owing to the failure of the injection-mass to pass, or owing to the small size of the fish

and the consequent difficulty of dissection, or to the bad state of preservation of the parts, it was not possible to trace out the vessels so delineated, but that, from analogy with other forms, there is reason to believe that the vessels occupy the positions indicated. There appears to be no reason to suppose that the circulus cephalicus is ever incomplete in front. The lumen of the transverse commissure between the roots of the anterior carotid arteries may possibly be closed in some cases, but the failure of the injection-mass to pass into the commissure is not necessarily a proof of the fact, since the pressure during the process of injection is equal on the two sides of the circulus. The transverse vessel is usually of small size, and its traversing the parasphenoid bone makes it difficult to dissect out with any degree of neatness.

In the selection of characters by which to classify the various types of arterial disposition, it has been assumed that the condition found in *Clupea* (Pl. LXIII. fig. 2) and *Engraulis* (fig. 1), where the circulus cephalicus is small, and does not involve the second, third, and fourth efferent branchial vessels, is the most simple and primitive, and that the connection of all four efferent branchial arteries with the circulus, such as occurs in *Gadus* (Pl. LXV. fig. 34), is the most specialized. This assumption is based partly upon the fact that the Gadoids are highly specialized in numerous other respects, whereas the Clupeoids are generally recognized as among the lowest of the Teleostean series; partly upon the fact that in *Amia*, an admittedly primitive Ganoid with Clupeoid affinities, the last three efferent branchial vessels are unconnected with the circulus cephalicus [1]; partly also upon the researches of Ayers (4) upon Elasmobranch fishes, which go to prove that the right and left sides of the circulus cephalicus are not the primitive paired aortæ such as occur in *Amphioxus* and in embryos of the true Vertebrata, but that the true dorsal aorta may persist as a median vestigial vessel traversing the circulus cephalicus, in the same manner as, according to Müller (16), it does in the Cyclostomi.

Pursuing this line of argument, we may legitimately conclude that where, as in the Salmon (fig. 7), Mackerel (fig. 6), and Carp (fig. 13), the circulus cephalicus, receiving the first and second efferent branchial vessels, is separated from the point of entry of the third and fourth by a length of the median aorta, the condition is more primitive than that in which the third and fourth vessels open at the posterior extremity of the circulus cephalicus, as in the Bass (Pl. LXIV. fig. 17). And further, the separation of the third and fourth vessels in the Anchovy (fig. 1) by a portion of the aorta indicates a more lowly condition than that seen in the Herring (fig. 2), where the two vessels open close together. There are thus two lines upon which we may regard specialization as proceeding: firstly, by the circulus cephalicus

[1] If such exists. The circulus appears to be suggested in Allis's figure (3. pl. xxxvi.), but its existence is denied by Ramsay Wright (25. p. 495). The arrangement in *Lepidosteus* is somewhat similar to that of *Amia*. See Hyrtl, 8. p. 235, and Müller, 17. pl. v. fig. 6.

involving the second, and later the third and fourth efferent branchial vessels; and secondly, by the progressive suppression in length of the median aorta, bringing about an approximation of the dorsal or proximal ends of the last three efferent branchial vessels on each side.

Owing to the fact that the one variety of specialization may occur quite independently of the other, or in conjunction with it, it becomes very difficult in some cases to compare the ultimate degree of specialization attained, since there is no evidence to show whether the inclusion of the efferent vessels into the circulus or the approximation of the efferent vessels by the suppression of the aorta is the more important. In the Salmon (fig. 7), for instance, the second efferent vessel opens into the circulus cephalicus—an indication of specialization; but a length of aorta persists between the circulus cephalicus and the third efferent vessel—a primitive character. In *Balistes* (fig. 5) the second vessel is free from the circulus cephalicus, and yet there is obvious specialization in the complete suppression of the aorta in the branchial region, resulting in the second, third, and fourth vessels opening close together, immediately behind the circulus. Who shall say whether, in the disposition of the efferent branchial vessels, the Salmon or the File-fish is the more primitive? Having recourse to the other anatomical features of these two forms, one would conclude that, the Salmon being in general structure the more primitive, the abbreviation of the aorta is as a mode of specialization more important than the backward extension of the circulus to include the second efferent branchial vessels. The conclusion is further justified by the fact that *Albula* (fig. 11), which is undoubtedly allied to *Megalops* (fig. 4) and *Chirocentrus*, differs from these genera in this latter respect.

This hypothesis, however, opens up the further question as to how far a backward extension of the circulus cephalicus is due to the longitudinal splitting of a part of the median aorta. Has, for instance, the condition found in *Megalops* and *Chirocentrus*, in which the circulus cephalicus extends back to the second branchial vessels, been brought about by the longitudinal division of a median vessel such as exists in *Clupea* (fig. 2) and *Engraulis* (fig. 1) between the first and second efferent branchial vessels? The suggestion has much to recommend it; more especially as the suppression of the median aorta cannot have operated here, or the two anterior carotids would be arising close together at the bottom of the fork of the first efferent branchials.

Another line of specialization, independent of the two former, can be traced in the confluence of the third and fourth efferent vessels. Having assumed that the separation of two consecutive efferent branchial vessels by a portion of the median aorta is a primitive feature, it follows that the separate entry into the aorta of the third and fourth vessels in *Engraulis* (fig. 1) is an indication of less specialization than the debouching of the two vessels together, as in *Clupea* (fig. 2); and further, that this latter

condition is more primitive than that found in *Megalops* (fig. 4), in which the third efferent vessel unites with the fourth on each side to form a short common trunk which carries the double charge of blood to the aorta. If this line of argumentation be extended to the cases in which the third and fourth vessels open into the circulus cephalicus instead of into the aorta, we are led to the conclusion that *Blennius* (fig. 35), having the Y-shaped system, is more specialized than *Gadus* (fig. 34), where the third and fourth vessels are disposed in the form of a V, and that this latter is more specialized than *Syngnathus* (fig. 33), where the two vessels find separate outlets into the circulus.

Whether much importance, however, can be attached to this last feature is open to considerable question, for the V-shaped system obtains in *Salmo* (fig. 7) and the Y-shaped one in *Osmerus* (fig. 10), and a similar relation exists between the Chinese Carp *Hypophthalmichthys* and our native Carp *Cyprinus* (fig. 13), while among the Siluroids, a presumably natural assemblage of forms, there are gradations from *Callichthys* (fig. 19) and *Liocassis* (fig. 18) with the V-shaped system, through *Clarias* (fig. 20), and *Silurus* (fig. 32), to *Saccobranchus* (fig. 31), with a typical Y-shaped arrangement.

The disposition of the efferent branchial vessels is independent of the shape of the head, except in so far as the slope of the vessels and the shape of the circulus is concerned. There is no connection, that is to say, between the shape of the head and the degree of suppression of the median aorta, or the entry of the efferent branchial vessels into the circulus rather than into the aorta. In long-headed forms like *Ammodytes* (fig. 3), *Sphyræna*, *Fistularia* (fig. 30), *Anguilla* (fig. 16), and *Syngnathus* (fig. 33) the circulus cephalicus is elongated in an antero-posterior direction; while in *Cottus* (fig. 27), *Lophius* (fig. 26), and others, with a broad, flat head, the gills are widely separated, and the circulus cephalicus is proportionately broad, the common trunks formed by the fusion of the third and fourth efferent vessels being also lengthened.

The differences in the arrangement of the efferent branchial vessels relatively to the circulus cephalicus and the aorta are not correlated with any differences in the position and extent of development of the epipharyngeal dentition. At the commencement of the inquiry, the suggestion occurred to my mind that the development of a large and elaborate dental apparatus might, by some process of natural selection, have resulted in the blood-vessels taking up a position of safety, out of the line of direct pressure between the epipharyngeal bones and the vertebral centra or the base of the skull. A minute examination of the individual cases shows, however, that the vessels do not experience any displacement under the circumstances, but obtain sufficient protection by running in grooves or arches in the epipharyngeal bones; in fact, as often as not, the epipharyngeal teeth lie immediately below certain of the efferent branchial blood-vessels. As an instance of two forms

with very similar vascular arrangement, but with widely different epipharyngeal dentition, may be mentioned the Salmon and the Mackerel. In the Salmon there are a pair of small patches of teeth borne by the fourth epibranchial bones, lying immediately ventral to the aortic extremities of the third efferent branchial vessels; but in the Mackerel there are a pair of great dentigerous pads underlying the mesial ends of the second, third, and fourth efferent branchial vessels, as well as a considerable part of the circulus cephalicus. In the Carp the dorsal aorta obtains the necessary protection by actually traversing the great horn-covered bony projection of the basioccipital, against which the lower pharyngeal teeth bite. In the Wrasse the vascular arrangement conforms to a very average type, being apparently quite unaffected by the large and elaborate pharyngeal mill developed in the vicinity of the posterior half of the circulus cephalicus. In *Exocœtus*, again, the epipharyngeal pad is of relatively enormous size, underlying the upper extremities of all four efferent branchial vessels, the anterior ends of the aorta and cœliaco-mesenteric artery, and the whole of the circulus cephalicus except the extreme anterior part; yet there is nothing very remarkable in the disposition of these vessels which might be accounted for by their relation to the epipharyngeal apparatus. Only in *Gobius*, *Cottus*, and *Molva*, of the forms examined, are the epipharyngeal dental pads situated entirely within the circulus cephalicus. The evidence afforded by forms devoid of epipharyngeal teeth is probably inconclusive, on account of the great possibility of the edentulous condition having been arrived at independently in different groups of fishes. In the Sprat and Pipe-fish the types of vascular arrangement are widely divergent. The Sprat closely resembles the Herring (fig. 2); the vessels of *Syngnathus* are shown in figure 33.

In order to discuss intelligibly the different forms of vascular arrangement met with, some form of classification, however artificial, is essential; and after careful consideration I have found it convenient to adopt the following scheme, based on the relations of the efferent branchial vessels to the circulus cephalicus and the dorsal aorta. In consideration of the unsatisfactory nature of the present classification of Teleostean fishes, a purely artificial scheme, founded upon the single character which forms the basis of the present communication, is likely to prove of more permanent utility for purposes of subsequent reference, than one which relies upon a classification which sooner or later may prove to be an unnatural grouping.

The great majority of the forms studied will be seen to come under the headings B and C, while the rarer and more extreme modifications occupy terminal positions in the classificatory scheme. The division of the groups B and C into the subgroups *b* and *c*, differing only in the transverse or oblique position of the confluent third and fourth efferent branchial vessels, appears arbitrary, but in practice there are very few forms which fail to

fall definitely into the one or the other subgroup. Without this subdivision, such remarkably different forms as *Anarrhichas* (fig. 23) and *Trigla* (fig. 28) would come under the same heading.

Classification of the Genera examined.

Group A. The first efferent branchial vessel opens into the circulus cephalicus, but the second does not.

Subgroup a. The third and fourth vessels open into the median aorta separately.—*Engraulis* (fig. 1).

Subgroup b. The third and fourth vessels open into the median aorta together.—*Clupea* (fig. 2), *Ammodytes* (fig. 3).

Subgroup c. The third and fourth vessels on each side unite to form a common trunk, which reaches the aorta some distance behind the second vessel.—*Chirocentrus*, *Megalops* (fig. 4).

Subgroup d. The third and fourth vessels on each side unite to form a common trunk, which reaches the median aorta immediately behind the second vessel.—*Balistes* (fig. 5).

Group B. The first and second efferent branchial vessels open into the circulus cephalicus, and the third and fourth into the median aorta at some distance behind the circulus.

Subgroup a. The third and fourth vessels open into the aorta together.—*Scomber* (fig. 6), *Hypophthalmichthys*, *Salmo* (fig. 7), *Coregonus*.

Subgroup b. The third and fourth vessels unite before opening into the aorta, the common stem being transverse to the length of the body.—*Mugil* (fig. 8), *Hippoglossus* (fig. 9), *Pleuronectes*, *Osmerus* (fig. 10), *Albula* (fig. 11).

Subgroup c. The third and fourth vessels unite, the common stem sloping backwards towards the aorta.—*Malapterurus* (fig. 12), *Scopelus*, *Cyprinus* (fig. 13), *Cobitis* (fig. 14), *Esox* (fig. 15), *Marcusenius*, *Anguilla* (fig. 16).

Group C. The first and second efferent branchial vessels open into the circulus cephalicus, and the third and fourth into the aorta immediately behind the circulus.

Subgroup a. The third and fourth vessels open into the aorta together.—*Labrax* (fig. 17), *Liocassis* (fig. 18), *Callichthys* (fig. 19), *Clarias* (fig. 20).

Subgroup b. The third and fourth vessels unite before opening into the aorta, the common stem being transverse to the length of the body.—*Perca* (fig. 21),

Mullus, *Corvina*, *Equula*, *Zeus* (fig. 22), *Trachinus*, *Anarrhichas* (fig. 23), *Zoarces*, *Centronotus*, *Sphyræna*, *Labrus* (fig. 24), *Hemichromis*, *Exocœtus* (fig. 25).

Subgroup c. The third and fourth vessels unite, the common stem sloping backwards towards the aorta.—*Lophius* (fig. 26), *Cottus* (fig. 27), *Trigla* (fig. 28), *Cyclopterus* (fig. 29), *Gobius*, *Fistularia* (fig. 30), *Lepadogaster*, *Saccobranchus* (fig. 31), *Silurus* (fig. 32).

Group D. The four efferent branchial vessels open into the circulus cephalicus.

Subgroup a. The third and fourth vessels open separately.—*Syngnathus* (fig. 33), *Motella*.

Subgroup b. The third and fourth vessels open together.—*Gastrosteus*, *Gadus* (fig. 34), *Molva*, *Hippocampus*.

Subgroup c. The third and fourth vessels unite before joining the circulus cephalicus.—*Blennius* (fig. 35), *Orthagoriscus* (fig. 36), *Tetrodon* (fig. 37).

Special Part.

In the case of species not figured, comparisons will be drawn with those figured forms which, in the arrangement of the efferent branchial vessels, they most nearly resemble, irrespective of the degree of affinity which upon other grounds may be considered to exist between the forms.

Further Remarks on Group A.

In *Engraulis* (fig. 1), there is a considerable difference in the size of the four efferent branchial vessels; the second is the broadest, and the first the narrowest. The dorsal aorta behind the fourth branchial vessel is wide and very thin-walled. This is also the case in *Clupea*. Although the scheme of classification which it has been found convenient to adopt brings *Ammodytes* (fig. 3) under the same subgroup as *Clupea* (fig. 2), there are several features which go to show that the association is an unnatural one. The circulus cephalicus in the former genus is much longer than broad, and extends back nearly to the point of entry of the second pair of vessels into the aorta; whereas in *Clupea* the posterior part of the circulus is transverse to the axis of the body, and forms with the first part of the aorta a **T** rather than a **Y**. The cœliaco-mesenteric artery arises in *Ammodytes* close behind the fourth efferent vessels, but much further back in *Clupea*. The origin of the subclavian arteries is slightly more posterior in *Clupea* than in *Ammodytes*. There are no differences between *Ammodytes lanceolatus* and *A. tobianus*, nor between *Clupea harengus* and *C. sprattus*.

Chirocentrus closely resembles *Megalops* (fig. 4). In both genera the median aortic stem found in *Engraulis* and *Clupea*

between the first and second efferent branchial vessels is wanting, owing to the backward extension of the circulus to the point of entry of the second branchial vessels into the aorta. The same feature is to be observed in *Balistes* (fig. 5), where the aortic stem between the second vessel and the common trunk of the third and fourth is also suppressed. The cœliaco-mesenteric artery of *Balistes* arises, not from the aorta, but from the third and fourth branchial vessels of the right side, immediately after their anastomosis.

If we disregard the modification of the efferent branchial circulation brought about in *Gymnarchus* by the increased functional importance of the swim-bladder, the efferent branchial system of this genus can be seen, from the description and figure published by Hyrtl (11. p. 11, and pl. 4. fig. 4), to conform with the type which characterizes subgroup A *c*.

Further Remarks on Group B.

The efferent branchial system of *Scomber* (fig. 6) bears a close resemblance to that of *Salmo* (fig. 7), but the cœliaco-mesenteric artery arises from the aorta immediately behind the fourth efferent branchial vessels and the subclavian arteries some distance farther back, whereas in *Salmo* the positions of the cœliaco-mesenteric and subclavian arteries are reversed. In the figure of *Scomber* given by Stannius (23. pl. v. fig. 4) the circulus cephalicus appears much too large, and the interval between the circulus and the entry of the third and fourth branchial vessels into the aorta too short.

In *Salmo trutta*, as also in *Osmerus* and *Coregonus*, the dorsal aorta is wide and thin-walled; but this is not the case in *Salmo salar*. The distance between the posterior angle of the circulus and the point of entry of the third efferent branchial vessel is proportionately longer in *Coregonus* than in *Salmo salar*, and proportionately shorter in *Salmo trutta*. A very reliable figure of the efferent branchial system of *S. trutta* has been given by Vogt (1. pl. L. fig. 2). The figure by Stannius of *S. salar* (23. pl. v. fig. 3) is incomplete, but is correct so far as it goes. In *Hypophthalmichthys* both the cœliaco-mesenteric and the subclavian arteries arise some distance behind the fourth efferent vessel. The circulus in this genus is broader than long.

In *Hippoglossus* (fig. 9), *Pleuronectes*, *Mugil* (fig. 8), *Esox* (fig. 15), and *Marcusenius* the distance between the posterior angle of the circulus cephalicus and the point of entry of the common trunk of the third and fourth branchial vessels is so short that these forms approach somewhat closely those included in subgroups C*b* and C*c*. In *Pleuronectes* the circulus cephalicus is longer than broad, whereas in *Hippoglossus* it is broader than long; the anterior carotids are closer together, and the transverse commissure between them is shorter than in *Hippoglossus*. The common trunk formed by the union of the third and fourth branchial vessels of the right side is much shorter than that

on the left, and the origin of the cœliaco-mesenteric artery is nearer the middle line than in *Hippoglossus*. In *Mugil* (fig. 8) the circulus cephalicus is considerably longer than broad, and the cœliaco-mesenteric artery arises from the median aorta behind the entry of the third and fourth branchial vessels, and not as in the two preceding genera. In *Osmerus* (fig. 10) and *Albula* (fig. 11), also, the cœliaco-mesenteric artery arises from the median aorta, but the subclavian arteries take their origin immediately behind the point of entry of the common trunk of the third and fourth branchial vessels into the aorta, and not behind the cœliaco-mesenteric artery as in *Mugil*.

In *Scopelus* the circulus cephalicus is small and nearly circular in shape, and the portion of median aorta intervening between its posterior angle and the mesial ends of the common trunks of the last two branchial vessels is unusually long. In *Malapterurus* (fig. 12) and *Esox* (fig. 15) the cœliaco-mesenteric artery arises from the aorta immediately ventral to the mesial ends of the common trunks of the third and fourth vessels; in *Cyprinus* (fig. 13), *Cobitis* (fig. 14), and *Marcusenius* it arises more posteriorly, and in *Anguilla* (fig. 16) considerably farther back. Except in this latter respect, the arrangement of the vessels in *Marcusenius* very closely resembles that of *Esox*.

Judging by the excellent figure of *Tinca* published by Hyrtl (**7**. pl. iv.), this genus exactly resembles *Cyprinus* in the disposition of the vessels of the efferent branchial system. The efferent vessels of *Cyprinus* were figured by Duverney (**6**. pl. ix. figs. 17 & 18) nearly 140 years ago; and although the figures are incomplete, the essential features are correctly represented. In *Cyprinus*, and according to Hyrtl in *Tinca* also, there are two pairs of subclavian arteries. The anterior pair, arising in front of the common trunks of the last two branchial vessels, supply the upper part of the pectoral arch, the posterior pair the lower part of the arch and the pectoral fins. A somewhat similar arrangement obtains in *Esox*. The mode of origin of the anterior pair has been remarked by Müller, and quoted by Stannius (**22**. p. 103, footnote 3) and Owen (**18**. p. 270, and **19**. p. 489), and these vessels are shown, although not named, in Maurer's figure (**13**. pl. xi. fig. 1).

The circulus is large in *Malapterurus* and *Anguilla*; and in the latter genus a median vessel, occupying the position of the anterior continuation of the primitive median aorta described in Selachian fishes by Ayers (**4**), may be traced forward from the posterior angle of the circulus. It soon forks, and is ultimately lost in the mucous membrane of the roof of the pharynx. In *Anguilla*, also, the origin of the posterior carotid artery is much farther removed from the entry of the first branchial vessel into the circulus than is usual. Meckel has stated (**14**. p. 193) that in the marine Eel, *Muræophis helena* (*Muræna helena*), the anterior lateral trunk formed by the union of the first and second branchial vessels is three times as long as the posterior one formed by the union of the third and fourth.

The efferent branchial vessels of *Chanos* have been described and figured by Hyrtl (12. pl. i. fig. 1). The first and second vessels open into the circulus cephalicus, the third some distance farther back into the median aorta, while the vessels from the fourth gills, after uniting with those from the epibranchial organs, unite with one another and open into the aorta at a point as far behind the opening of the third branchial vessel as the latter is behind the circulus cephalicus. The genus thus falls into group B, but, owing to the exceptional disposition of the fourth pair of vessels, it cannot be included in any of the three subgroups recognized.

Further Remarks on Group C.

The circulus cephalicus is narrow in front in *Labrax* (fig. 17), but it is broad in the Siluroids *Liocassis* (fig. 18), *Callichthys* (fig. 19), and *Clarias* (fig. 20). In *Labrax* the cœliaco-mesenteric artery arises from the aorta immediately behind the fourth efferent branchial. It has the same relations in *Clarias*, but is somewhat more posterior in *Callichthys*, and considerably so in *Liocassis*. The subclavian arteries arise behind the cœliaco-mesenteric artery in *Labrax*, *Clarias*, and *Callichthys*, but close behind the fourth branchial vessel in *Liocassis*. Although *Clarias* is introduced into the subgroup C *a*, it really occupies an intermediate position between C *a* and C *b*, since there is a very short common trunk on each side between the last two branchial vessels and the aorta. The genus *Heterotis* I have not been able to examine, but it is tolerably certain, from the description given by Hyrtl (9. p. 87), that it should be included in the subgroup C *a*.

In *Mullus* and *Corvina* the disposition of the cœliaco-mesenteric and subclavian arteries is as in *Perca* (fig. 21), but the circulus cephalicus is broader in front. The circulus has the form of a regular heptagon in *Mullus*, while in *Corvina* it is pear-shaped, the broad end being anterior. In *Equula* it is oval in shape and longer than broad; but otherwise the relations of the parts are as in *Perca*. With regard to *Perca* itself, Hatchett Jackson, in his edition of Rolleston's 'Forms of Animal Life' (21. p. 88), states that the "cœliaco-mesenteric artery * * * springs from the right epibranchial artery before it fuses with its fellow." This does not accord with my own observations. Hyrtl in his figure of *Lucioperca* (7. pl. i. fig. 1) shows the common trunks of the third and fourth branchial vessels entering the aorta at some distance from the posterior angle of the circulus. The transverse commissure, also, between the anterior carotids ("die vorderen oder kleinen Kopfarterien") is situated farther forward than in *Perca*.

In *Zeus* (fig. 22) the circulus is broader, and the cœliaco-mesenteric artery arises, not from the aorta, but from the common trunk of the last two branchial vessels of the right side. *Zoarces* resembles *Anarrhichas* (fig. 23) in the oval shape of the circulus and in the narrow anterior prolongation of the latter, but the

common trunk formed by the union of the third and fourth branchial vessels is shorter. In *Centronotus* and *Trachinus* the anterior prolongation of the circulus is wanting, but otherwise the vessels of the pharyngeal roof are disposed as in *Anarrhichas*. The circulus of *Sphyræna* is twice as long as broad, and the posterior angle is very acute; the subclavian arteries arise farther forward than in *Anarrhichas*, and have more the relations of those of *Labrus* (fig. 24).

Hemichromis differs from *Labrus* in having a much broader circulus cephalicus, and in the more posterior origin of the subclavian arteries. The circulus of *Exocœtus* (fig. 25) is oval and longer than broad; the cœliaco-mesenteric artery arises from the circulus cephalicus immediately to the right of the aorta.

Owing to the absence of the fourth gill and its efferent vessel in *Lophius* (fig. 26), the right of this form to rank under subgroup C *c* rather than C *a* is somewhat conjectural. The matter is, however, of no great importance. The circulus is very wide, and the cœliaco-mesenteric artery, which is considerably thicker than the aorta, branches soon after its origin. Concerning *Lophius* Meckel has written (**14.** p. 192): "*Lophius piscatorius* hat, statt der gewöhnlichen drei bis vier, nur zwei sehr lange Kiemenblutadern. Von der vordersten Kieme entsteht ein einfacher Stamm, der zweite wird durch die Vereinigung der zweiten und dritten Kiemenblutader gebildet, die ungefähr eben so lang als der gemeinschaftliche Stamm getrennt verlaufen." My own observations are thus not in accord with those of Meckel. Most ichthyologists admit, with Müller (**17.** p. 47), that the three gills present in *Lophius* are the anterior three of the four gills more normally present; and the coupling of the first and second efferent branchial vessels, the third remaining solitary, is by analogy with allied forms a far more intelligible arrangement than that described in the above-quoted passage from Meckel's text-book.

In *Cottus* (fig. 27), although the circulus is so wide in front, the anterior carotids lie very close together, and the transverse commissure, which takes a curious bend forward, is therefore short. The cœliaco-mesenteric artery of *Trigla* (fig. 28) is a double vessel arising from the common trunk of the last two branchial vessels of the right side. There are no differences between the efferent branchial systems of *Trigla cuculus* and *T. gurnardus*. The anterior part of the circulus cephalicus of *Cyclopterus* (fig. 29) is very curiously shaped, and the transverse vessel may possibly be wanting. I have been unable to find it in the three specimens dissected. In the figure of *Cyclopterus* given by Stannius (**23.** pl. v. fig. 1) the subclavian arteries are drawn too wide; and they are incorrectly described on page 156 as branchial veins. *Lepadogaster* does not differ materially from *Cyclopterus*, except that the anterior part of the circulus cephalicus conforms more to the normal type. *Gobius* differs from *Cottus* (fig. 27) in the wider separation of the anterior carotids, the greater breadth of the circulus cephalicus, the more posterior entry of the second

branchial vessels into the circulus, and the more posterior origin of the subclavian arteries.

In *Fistularia* (fig. 30) the slope of the common trunks of the third and fourth efferent branchial vessels is so slight that the genus might with equal propriety be classed under subgroup C *b*, and the fact that these common trunks do not enter exactly at the posterior angle of the circulus cephalicus makes it difficult to uphold its claim to come into group C at all. The circulus is long and abruptly terminated in front. The aorta, after giving origin to the cœliaco-mesenteric artery, is unsymmetrical, and runs to the left side of the vertebral centra. In *Silurus* (fig. 32) the posterior angle of the circulus cephalicus is not exactly coincident with the mesial ends of the common trunks of the efferent branchial vessels 3 and 4, as it is in *Saccobranchus* (fig. 31); and thus the form really occupies an intermediate position between the subgroups C *c* and B *c*, in which latter subgroup the Siluroid genus *Malapterurus* (fig. 12) has already been placed. With regard to *Saccobranchus*, it has already been pointed out by Hyrtl (10. p. 306) that the first branchial vessel unites with the second (which is another way of stating that they both open into the circulus), the third with the fourth, and that the efferent vessels of the lung-sac open into the fourth branchial vessel.

Further Remarks on Group D.

In *Syngnathus* (fig. 33) the dorsal aorta is not median but runs slightly to the left side of the vertebral centra. The cœliaco-mesenteric artery arises at the posterior angle of the circulus cephalicus. From the same place arises a single vessel forking posteriorly into the two subclavian arteries. *Hippocampus* closely resembles *Syngnathus*, but since the openings of the third and fourth efferent vessels are closer together, the genus comes under the second subgroup, D *b*. The circulus cephalicus, also, is less elongated than in *Syngnathus*. In both genera, however, the front of the circulus is broad and its posterior angle very acute. The dorsal aorta of *Hippocampus* is median, and the subclavian arteries arise from its sides directly, and not through the intervention of a common root. In *Gastrosteus* the circulus cephalicus is not more than twice as long as broad. The subclavian arteries arise a short distance behind its posterior angle, and the cœliaco-mesenteric a considerable distance behind.

Molva differs from *Gadus* (fig. 34) mainly in the fact that the subclavian arteries arise from the circulus cephalicus farther from the median line, and consequently more remote from the dorsal aorta. The cœliaco-mesenteric forks close to its origin in both genera, as it also does in *Motella*. *Motella* very closely resembles *Molva*, and it is only the slight separation of the mesial extremities of the last two branchial vessels which causes the genera to be placed in separate subgroups. *Gadus callarias* (*G. morrhua*), figured by Müller (16. pl. iii. fig. 13) and by Stannius (23. pl. v. fig. 2), does not appear to differ materially from *Gadus æglefinus*,

except that the subclavian arteries arise farther from the median line, just as they do in *Molva*. In *Lota*, as described and figured by Hyrtl (**7**. pl. i. fig. 2), there is a tendency for the last two efferent branchial vessels to unite before opening into the circulus. The fact that the cœliaco-mesenteric artery arises from the circulus is shown in Hyrtl's figure, and is quoted by Stannius (**22**. p. 103, footnote 3) and by Owen (**19**. p. 490).

In *Blennius* (fig. 35) the circulus cephalicus is narrow in front, the cœliaco-mesenteric artery arises from the aorta immediately behind the circulus, and the subclavian arteries are just behind this. In *Orthagoriscus* (fig. 36) the aorta is unsymmetrical, running to the right side of the vertebræ; the cœliaco-mesenteric artery is formed by the union of a pair of vessels arising from the common trunks formed on each side by the confluence of the third and fourth efferent branchial vessels. The mesial ends of all the efferent vessels are closely approximated. The gills in *Orthagoriscus* are remarkably prolonged in a backward direction. The efferent branchial vessel of each emerges from near the middle of the full extent of the gill, and not, as is more usual, from the upper end. It is formed by the union of one vessel coming from the lower part or gill proper, with another from the dorso-posterior prolongation, in a manner already made clear by Alessandrini (**2**) and Milne-Edwards (**15**. p. 335, footnote 2). Judging from Alessandrini's description, the peculiar mode of formation of the cœliaco-mesenteric artery in *O. truncatus* does not occur in the species examined by him (*O. mola*).

In *Tetrodon* (fig. 37) there are only three gills on each side, and three efferent branchial vessels, the fourth of the normal series being absent. The reason for putting the genus in the subgroup D *c*, characterized by the union of the third and fourth efferent vessels into a common trunk, is to be found in the relation of the cœliaco-mesenteric artery to the third efferent vessel of the right side. The association is such that, were the fourth vessel present, it could not reach the circulus between the third vessel and the cœliaco-mesenteric. Both the right and left subclavian arteries arise from the right side of the circulus, and the latter is nearly circular in shape.

Conclusions.

It will be seen from the foregoing observations that very considerable diversity in the arrangement of the efferent branchial blood-vessels is to be met with in the Teleostean fishes. The type of vascular arrangement is constant for different species of the same genus, and does not vary to any considerable extent in different genera of the same family. If, as in the Siluroid fishes, some widely divergent types are included in the same family, there are to be found intermediate types which act as connecting-links between these extremes.

With regard, however, to families which, in the at present accepted taxonomy of the group, are brought into close relationship,

the characters of the efferent branchial system fail to afford any convincing evidence as to the correctness or the reverse of such association. Thus, while the Gadoids have one sharply marked type of arterial arrangement, the Clupeoids another, and the Salmonoids a third, in the disposition of the efferent vessels the Lophobranchii resemble the first, the Ophidiidæ the second, and the Scombridæ the last,—a most unnatural coupling of the families. It does not appear, therefore, that the facts revealed by the present inquiry can be applied with any probability of success to the interpretation of the affinities of the family and larger groups of Teleostei.

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EXPLANATION OF THE PLATES.

Efferent Branchial Blood-vessels of the first, second, third, and fourth Gills of Teleostean Fishes, as seen after stripping off the mucous membrane from the roof of the pharynx.

The dorsal aorta, the cœliaco-mesenteric artery, and the subclavian artery are respectively indicated in all the figures by the letters, *a*, *c*, and *s*.

Plate LXIII.

Fig. 1. *Engraulis encrasicholus*, p. 947.
2. *Clupea harengus*, p. 947.
3. *Ammodytes lanceolatus*, p. 947.
4. *Megalops cyprinoides*, p. 947.
5. *Balistes aculeatus*, p. 948.
6. *Scomber scombrus*, p. 948.
7. *Salmo salar*, p. 948.
8. *Mugil capito*, p. 948.
9. *Hippoglossus vulgaris*, p. 948.
10. *Osmerus eperlanus*, p. 949.
11. *Albula conorhynchus*, p. 949.
12. *Malapterurus electricus*, p. 949.
13. *Cyprinus carpio*, p. 949.

Plate LXIV.

Fig. 14. *Cobitis tænia*, p. 949.
15. *Esox lucius*, p. 949.
16. *Anguilla vulgaris*, p. 949.
17. *Labrax lupus*, p. 950.
18. *Liocassis longirostris*, p. 950.
19. *Callichthys littoralis*, p. 950.
20. *Clarias magur*, p. 950.

Fig. 21. *Perca fluviatilis*, p. 950.
22. *Zeus faber*, p. 950.
23. *Anarrhichas lupus*, p. 950.
24. *Labrus maculatus*, p. 951.
25. *Exocœtus brachysoma*, p. 951.

PLATE LXV.

Fig. 26. *Lophius piscatorius*, p. 951.
27. *Cottus scorpio*, p. 951.
28. *Trigla cuculus*, p. 951.
29. *Cyclopterus lumpus*, p. 951.
30. *Fistularia tabaccaria*, p. 952.
31. *Saccobranchus fossilis*, p. 952.
32. *Silurus glanis*, p. 952.
33. *Syngnathus acus*, p. 952.
34. *Gadus æglefinus*, p. 952.
35. *Blennius pholis*, p. 953.
36. *Orthagoriscus truncatus*, p. 953.
37. *Tetrodon palembangensis*, p. 953.

4. On the Reptiles, Batrachians, and Fishes collected by the late Mr. John Whitehead in the Interior of Hainan. By G. A. BOULENGER, F.R.S.

[Received October 31, 1899.]

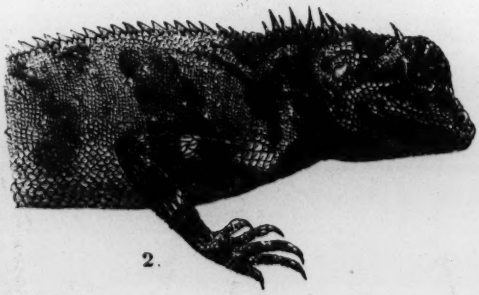
(Plates LXVI.–LXIX.)

During his short stay in Hainan, where he died on June 2 of the present year, Mr. John Whitehead had succeeded in collecting a small number of cold-blooded vertebrates in the Five-finger Mountains, in the interior of the island. The fact that so many of the few species represented in the collection are new, tends to show how rich a harvest these unexplored mountains would have yielded but for the fatal climate which has deprived the zoological world of one of its most enthusiastic and successful members.

REPTILES.

1. DRACO WHITEHEADI, sp. n. (Plate LXVI. fig. 1.)

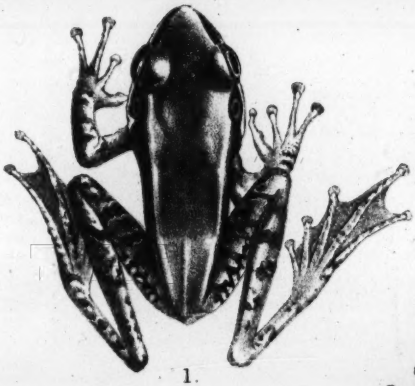
Head small; snout considerably longer than the diameter of the orbit; nostril lateral, directed outwards; tympanum scaly. Upper head-scales unequal, strongly keeled; 8 or 9 upper labials. Male's gular appendage very large, once and a half as long as the head. A rudimentary nuchal crest. Dorsal scales a little larger than ventrals, irregular, obtusely keeled; on each side of the back a series of enlarged, keeled dorsal scales. The fore limb stretched forward reaches the tip of the snout, the hind limb between the elbow and the axilla. Reddish brown above, with dark transverse



P.J.Smit del. et lith. Mintern Bros. imp.

1.DRACO WHITEHEADI. 2.ACANTHOSAURA HAINANENSIS.

BRITISH
25 AP 1900
MUSEUM

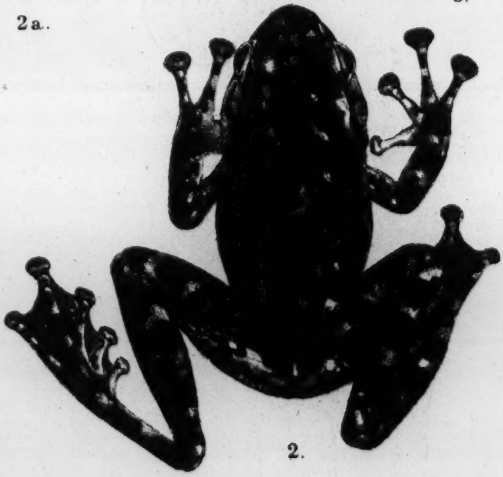


1.

1a.

2a.

3.



2.

P.J Smit. del. et lith. Mintern Bros. imp.

1. RANA GRAMINEA. 2. STAUROIS HAINANENSIS.
3. RHACOPHORUS OXYCEPHALUS.

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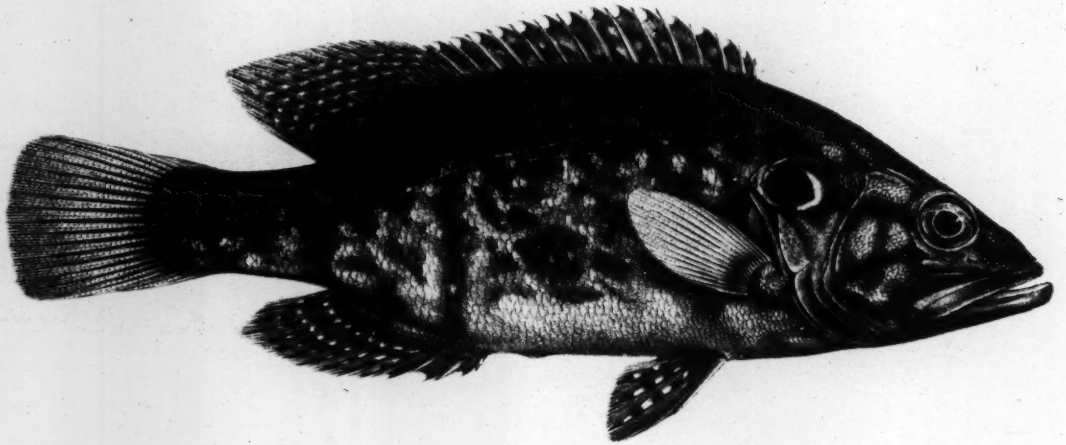

J.Green del. et lith.

COREOPERCA WHITEHEADI.

Mintern Bros. imp.

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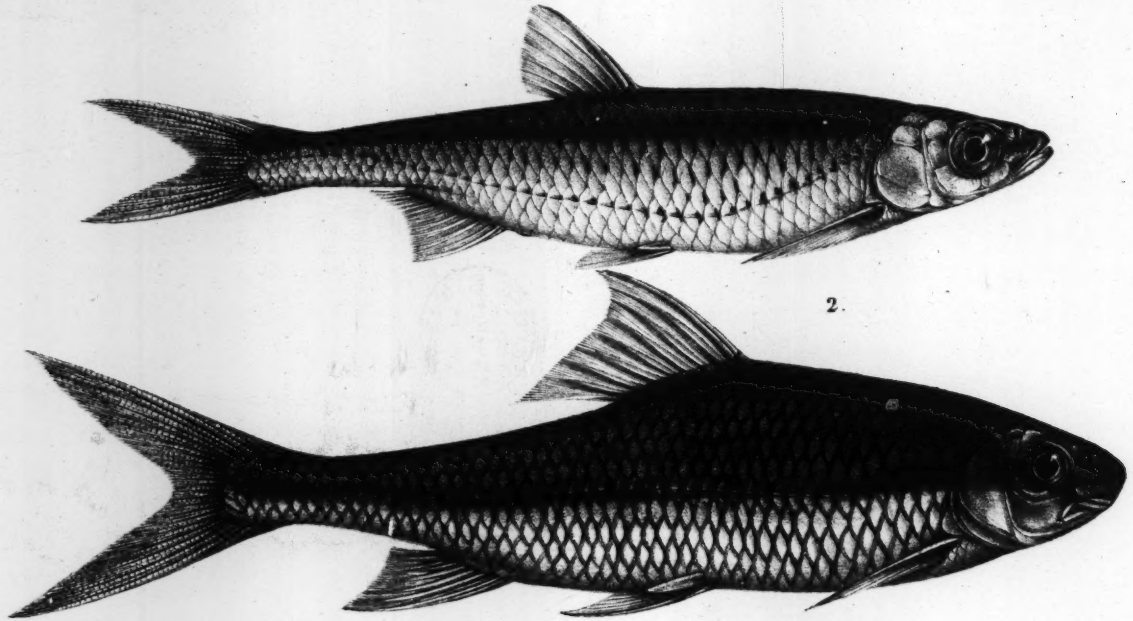


2.

1.

J.Green del. et lith.

Mintern Bros. imp.

1. GYMNOSTOMUS LEPTURUS. 2. BARILIUS HAINANENSIS.

BRITISH
25 AP 1900
MUSEUM

bars and small black spots; wing-membranes brick-red above, with small round black spots, colourless and unspotted beneath; gular appendage blue at the end, blackish in front, and red behind at the base.

Total length....	232 millim.	Fore limb ..	34 millim.
Head	17 „	Hind limb..	43 „
Width of head..	11 „	Tail	148 „
Body	69 „		

Very closely allied to *D. maculatus* Gray, but snout longer and coloration different.

A single male specimen.

2. Acanthosaura hainanensis, sp. n. (Plate LXVI. fig. 2.)

Snout as long as the diameter of the orbit; canthus rostralis and supraciliary edge angular; tympanum smaller than the eye-opening; upper head-scales keeled, larger on the supraorbital region and in the middle of the forehead; a spine, measuring one third the diameter of the orbit, terminates the supraciliary edge; 11 or 12 upper and as many lower labials; gular scales strongly keeled, smaller than the ventrals. An oblique fold on each side of the neck, in front of the shoulder; a spine, measuring two fifths the diameter of the orbit, on each side of the nape above the tympanum. Nuchal crest not continuous with the dorsal, composed of rather slender compressed spines, the longest of which measure nearly half the diameter of the orbit. Dorsal crest low, composed of triangular compressed scales pointing backwards, subequal in size throughout the back. Dorsal scales very small, intermixed with irregularly scattered, enlarged, rhomboidal, more or less strongly keeled ones; ventral scales about as large as the enlarged dorsals, strongly keeled. Fore limb and tibia above with subequal keeled scales, femur with unequal ones; fourth finger a little longer than third; the adpressed hind limb reaches the eye. Tail feebly compressed, covered with uniform strongly keeled scales, which are larger on the lower surface. Olive-brown above, with rather indistinct wavy darker cross-bars; a dark, light-edged rhomboidal marking between the shoulders, produced forwards along the base of the nuchal crest; antehumeral fold blackish; limbs and tail with light transverse bars.

Total length....	250 millim.	Fore limb ..	52 millim.
Head	25 „	Hind limb ..	79 „
Width of head..	17 „	Tail	145 „
Body	70 „		

Most nearly allied to *A. crucifera* Blgr.

A single female specimen.

3. Calotes versicolor Daud.

4. Tropidonotus chrysargus Schleg.

BATRACHIANS.

1. RANA GRAMINEA, sp. n. (Plate LXVII. fig. 1.)

Vomerine teeth in two short oblique series between the choanæ, nearer to each other than to the latter. Head depressed, as long as broad; snout rounded, scarcely projecting, as long as the diameter of the orbit; canthus rostralis well-marked; loreal region concave; nostril nearer the end of the snout than the eye; interorbital space as broad as the upper eyelid; tympanum very distinct, three fourths the diameter of the eye. Fingers and toes rather slender, with small but well-developed disks; first finger not extending beyond second; toes nearly entirely webbed; a single, feebly prominent, oval, inner metatarsal tubercle. The tibio-tarsal articulation reaches beyond the tip of the snout; tibia as long as the distance from end of snout to sacrum. Skin smooth; a moderately broad, feebly prominent glandular lateral fold; another fold from below the eye to the shoulder, followed by a strong glandule. Bright green above, brownish on the sides of the head and body, below the canthus rostralis and the dorso-lateral fold, and on the limbs; upper lip white; limbs with regular dark cross-bars; hinder side of thighs marbled dark brown and yellow; lower parts white. Male with two external vocal sacs, in front of the arms; no humeral gland.

From snout to vent 48 millim.

Allied to *R. erythræa* Schleg. Distinguished by the shorter snout, the longer hind limbs, the external vocal sacs, and the coloration. Also allied to *R. jerboa* Gthr. and *R. whiteheadi* Blgr., in which the digital disks are larger and the hind limb longer still.

Two male specimens.

2. RANA ANDERSONI Blgr.

This species, first discovered in the Hotha Valley, Yunnan, by Dr. J. Anderson, has since been found in the Kakhyen Hills, Upper Burma, by Signor L. Fea, and at Kuatun, N.W. Fokien, by Mr. J. D. La Touche.

3. STAUROIS HAINANENSIS, sp. n. (Plate LXVII. fig. 2.)

Head as long as broad or slightly broader than long; snout short, truncate, projecting; canthus rostralis strong; loreal region nearly vertical, concave; nostril midway between the eye and the end of the snout; interorbital space as broad as the upper eyelid; tympanum distinct, one third or two fifths the diameter of the eye. Fingers slender, first longer than second, with very large disks; toes webbed to the disks, which are a little smaller than those of the fingers; subarticular tubercles feebly prominent; a very indistinct inner metatarsal tubercle. The tibio-tarsal articulation reaches the tip of the snout or a little beyond. Skin smooth above in the adult, warty in the young; lower part

smooth. Olive above, spotted with black, or blackish with pale olive markings; limbs with dark cross-bars; hinder side of thighs with a black reticulation.

From snout to vent 58 millim.

Larva with a large pectoral adhesive disk (see P. Z. S. 1893, p. 526). Beak formed of two pieces, an upper and a lower, feebly denticulate, not ribbed; lower lip not fringed; the horny teeth form 3 uninterrupted and 2 paired series on the upper lip, 2 uninterrupted and 1 narrowly interrupted series on the lower lip, an arrangement that may be expressed by the formula $\frac{2}{1}\frac{3}{2}\frac{2}{1}$.

Closely allied to *Staurois natator* Gthr. Distinguished by the shorter head. The tadpole, on the other hand, stands nearest to that of *Rana latopalmata* Blgr.

Three specimens: a female, a young, and an advanced tadpole.

4. Rhacophorus leucomystax Gravh.

5. Rhacophorus oxycephalus, sp. n. (Plate LXVII. fig. 3.)

Vomerine teeth in two oblique series between the choanæ, the inner front edge of which they nearly touch. Head as long as broad; snout pointed, as long as or a little longer than the diameter of the orbit; canthus rostralis distinct; loreal region concave; nostril a little nearer the tip of the snout than the eye; interorbital space a little narrower than the upper eyelid; tympanum distinct, half the diameter of the eye. Fingers with a distinct rudiment of web; toes entirely webbed; disks of fingers nearly as large as the tympanum, of toes a little smaller; a very small inner metatarsal tubercle. The tibio-tarsal articulation reaches beyond the tip of the snout. Skin smooth or with small warts above; belly granular. Greyish or brown above, spotted or marbled with darker; a dark transverse band or triangular marking, base forwards, between the eyes; limbs with dark cross-bars; groin and back of thighs marbled black and yellow; lower parts white. Male with an internal vocal sac.

From snout to vent 57 millim.

Four specimens.

6. Bufo melanostictus Schn.

FISHES.

Coreoperca.

Coreoperca, Herzenstein, Ann. Mus. Zool. St. Pétersb. 1896, p. 11.

Body compressed; scales small, cycloid, concentrically striated. Lateral line complete; tubes straight, occupying the greater length of the scale. Mouth large, protractile; maxillary exposed, with

supplemental bone; villiform teeth in jaws and on vomer and palatines; no canines; tongue smooth; head partly naked; præopercle serrated, with a few antrorse spines on the lower border; opercle with two spines. Gill-membranes separate; seven branchiostegals; pseudobranchiæ present. Dorsal fins confluent, XIV–XV 11–14, the spinous portion much longer than the soft; anal short, III 7–11; caudal rounded. Pectoral symmetrical, rounded, rays 16. Ventrals below the pectorals, close together, with a strong spine and five branched rays, the last of which is connected with the belly by a membrane.

The type species of this genus of *Serranidæ*, allied to *Siniperca*, is from the interior of North Corea[1]. It is highly interesting to add a second species from the interior of Hainan.

1. Coreoperca whiteheadi, sp. n. (Plate LXVIII.)

Depth of body equal to length of head, 3 times in total length. Snout $1\frac{1}{3}$ diameter of eye, which equals interorbital width, $\frac{1}{4}$ length of head; lower jaw projecting beyond the snout; maxillary extending a little beyond vertical of posterior border of eye, the width of its distal extremity a little less than diameter of eye; præorbital entire; cheeks and opercles scaly, rest of head naked; præopercle finely serrated, without enlarged spines at the angle; opercular spines strong. Dorsal XV 14, originating above base of pectoral; spinous portion twice as long as the soft; spines strong, short, increasing in length to the sixth, which equals $\frac{1}{2}$ length of head; longest soft rays nearly $\frac{1}{2}$ length of head. Pectoral $\frac{1}{2}$ length of head. Anal III 11; second spine longest, a little shorter than longest dorsal spines. Caudal rounded, subtruncate. Sq. 80 $\frac{14}{51}$; l. l. 63. Brown, with dark marblings and whitish dots; a dark streak from below the eye to the angle of the præopercle and another from the eye to a large, black, white-edged ocellar spot

[1] Having had the privilege of examining the type specimens of *Coreoperca herzi*, Herzenst. l. c., preserved in the St. Petersburg Museum, I add a description of them for comparison with *C. whiteheadi*:—

Greatest depth at origin of dorsal fin, 3 to $3\frac{1}{2}$ times in total length, length of head $2\frac{3}{4}$ to 3 times. Snout as long as diameter of eye, $\frac{1}{4}$ length of head, and twice width of interorbital region; lower jaw not projecting; maxillary extending to below posterior third of eye, the width of its distal extremity about half diameter of eye; præorbital entire; cheeks and opercles scaly, rest of head naked; præopercle with two strong bifid spines at the angle and two or three antrorse spines on the lower border; opercular spines strong. Dorsal XIV 11–12; originating above base of pectoral, spinous portion twice as long as the soft; spines strong, increasing in length to the fifth, which equals $\frac{2}{3}$ length of head, but is considerably shorter than the longest soft rays. Pectoral $\frac{2}{3}$ length of head. Anal III 7, spines very strong, third a little longer than first, second longest and a little longer than longest dorsal spine. Caudal rounded. Sq. 76–82 $\frac{14\text{–}15}{35}$; l. l. 51–56. Brown; a dark streak from below the eye to the angle of the præopercle; a black spot, edged with white anteriorly, between the opercular spines; body with some dark brown spots intermixed with whitish dots; a regular series of dark spots along the base of the dorsal.

Total length 85 millim.

Pung Tung, Corea.

between the opercular spines; some light dots on the soft dorsal and anal and on the membrane between the ventral rays.

Total length 155 millim.

A single specimen.

2. Discognathus imberbis Vincig.

A species described from the Karen Hills, Burma.

3. Gymnostomus lepturus, sp. n. (Plate LXIX. fig. 1.)

Depth of body 4 times in total length, length of head 5 times. Head $1\frac{2}{3}$ as long as broad; snout broad, rounded; width of mouth nearly half length of head; lower jaw with a sharp, horny edge; diameter of eye equal to length of snout, $3\frac{1}{2}$ times in length of head, $1\frac{1}{2}$ in interorbital width. Dorsal III 8, midway between end of snout and base of caudal; first branched ray longest, a little shorter than the head, last ray longer than those preceding it, $\frac{3}{4}$ length of head. Pectoral as long as head. Ventrals below middle of dorsal. Anal III 6, as deep as dorsal. Caudal deeply bifurcate, $1\frac{1}{3}$ length of head. Caudal peduncle thrice as long as deep. Sq. $49\frac{7}{6}$; 4 scales between the lateral line and the ventral. Olive above, silvery beneath; an ill-defined dark lateral streak.

Total length 165 millim.

A single specimen.

4. Barilius hainanensis, sp. n. (Plate LXIX. fig. 2.)

Depth of body equal to length of head, $4\frac{2}{3}$ times in total length. Head twice as long as broad; snout pointed, not projecting beyond the mouth, as long as diameter of eye, which is $3\frac{1}{2}$ times in length of head and equals interorbital width; mouth extending hardly to below anterior border of eye; suborbitals entirely covering the cheek. Dorsal II 7, originating just behind ventral and situated at equal distance from the eye and the root of the caudal; first branched ray $\frac{2}{3}$ length of head. Pectoral a little shorter than head, not reaching ventral. Anal II 14. Caudal deeply bifurcate, as long as head. Caudal peduncle nearly thrice as long as deep. Sq. $46\frac{6}{3}$. Silvery, darker on the back; scales above the lateral line black at the base.

Total length 130 millim.

A single specimen.

5. Opsariichthys platypus Schleg.

A species known from Japan and Formosa.

EXPLANATION OF THE PLATES.

Plate LXVI.

Fig. 1. *Draco whiteheadi*, p. 956, with side-view of head.
2. *Acanthosaura hainanensis*, p. 957.

PLATE LXVII.

Fig. 1. *Rana graminea*, p. 958.
1*a*. „ „ Side view of head.
2. *Staurois hainanensis*, p. 958.
2*a*. „ „ larva, lower view of body.
3. *Rhacophorus oxycephalus*, p. 959.

PLATE LXVIII.

Coreoperca whiteheadi, p. 960.

PLATE LXIX.

Fig. 1. *Gymnostomus lepturus*, p. 961, ½ nat. size.
2. *Barilius hainanensis*, p. 961.

5. On a Collection of Butterflies made by Mr. Richard Crawshay in British East Africa. By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c., Senior Assistant-Keeper, Zoological Department, British Museum.

[Received September 20, 1899.]

(Plate LXX.)

During the past summer I received from Mr. Crawshay a box of Lepidoptera and a letter dated February 8th, 1899, addressed from Neugia, as follows :—

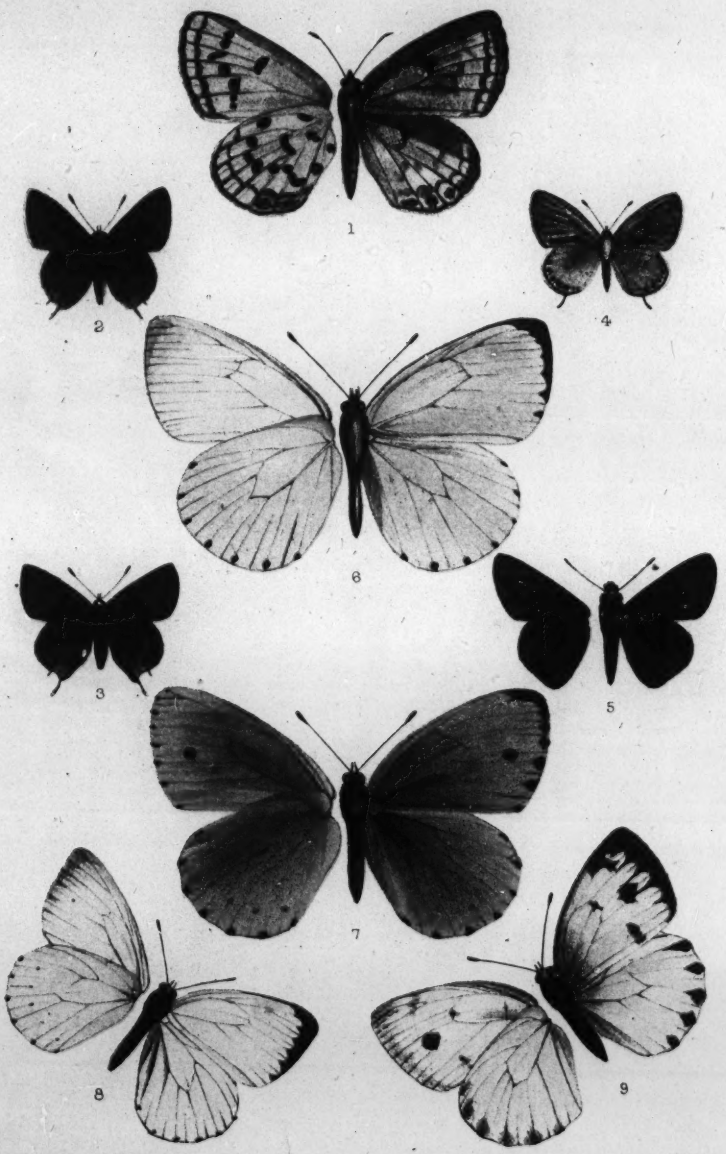
"A few lines to let you know that I have lately returned from a journey into Maranga, the S. and S.W. slopes of Mt. Kenya; and that I was able to take some Butterflies, which, I think, will please you.

"From this—I mean the mention of mighty Kenya and its 18,600 feet—you must not infer that these insects have been collected at any great altitude. Maranga is not so high as other parts of Kikuyu to the westward,—for instance the neighbourhood of Fort Smith, which is 6400 feet. As a matter of fact it does not average, I suppose, more than 5600 feet; rising to the N. and N.E. gradually into the mighty belt of forest surrounding the mountain for many thousands of feet, and falling away to the W. and S.W. of the Tana River, which, where we crossed it, is 3850–3900 feet.

"In all the thousands of miles I have travelled in Africa, I have never seen a more lovely and more *possible* country than Maranga; nor more splendid specimens of its peoples than are the Wakikuyu—though they are at present suspicious of and hostile to everyone from the outer world. The Wakamba are the most veritable *worms* in comparison with them.

"However, you want to know something more of the surprises which I hope are in store for you in the shape of the Butterflies.

"The most promising of these are Skippers and Blues—one a very large and powerful Blue with almost black wings on the inside, which show a Purple-Emperor-like glow, though with a



F.W. Frohawk del. et lith. West, Newman chromo

BUTTERFLIES FROM BRIT. E. AFRICA.

BRITISH
25 AP 1900
MUSEUM

tinge of port-wine colour about it [1]. This Blue (of which I think I took a pair) and another very active and cunning insect—as you will see from the note appended on the paper envelope—were taken on a stinking crocodile's head, than which nothing smells more foully; otherwise—I mean without this—I should probably never have seen the former, nor taken either of them.

"A hippopotamus skull far gone in putrefaction also proved attractive, and did me several good turns in enabling me to get on equal terms with other insects: on this I took the only *Charaxes* I saw, I think, on the whole journey, though one I know well. Of Moths I also took a nice lot."

On his return Mr. Crawshay had a narrow escape from a wounded bull Rhinoceros, but by a fortunate shot, whilst lying in the grass he managed to hit it in the heart, and so escaped with his life.

The collection of Moths will be worked out by Sir George Hampson. The Butterflies are represented by 127 specimens referable to 69 species, of which 3 are new to science; the most interesting to me is a new species of *Chloroselas* allied to *C. tamaniba* of Walker from Suakin, but apparently distinct, and clearly proving that Prof. Aurivillius was in error in referring the Somali insect *C. esmeralda* to that species. *C. tamaniba* is considerably larger than *C. esmeralda*, has the posterior half of the primaries, including the base, blue; and the anal orange spot of the secondaries is well-defined as in the present species.

Nymphalidæ.

1. Monotrichtis safitza Hewits.

Muthambi River, Ndya, 7th January, 1899.
"They swarm on the banks of the stream" (*R. C.*).

2. Neocœnyra duplex Butl.

Slopes of Nthatha Hill, Kitwi, 4700 feet, 31st December, 1898.

3. Neocœnyra gregorii Butl.

Muthambi River, Ndya, 7th January, 1899.
One much worn example.

4. Charaxes varanes Cram.

♂, Muthambi River, Ndya, 13th January, 1899.
"Taken on the crocodile's head (hippopotamus' skull?); the only one of this species which I have seen during my week here" (*R. C.*).

5. Precis cloantha Cram.

♂, Plains N. of the Tana River, Kikuyu, 4500 feet, 5th January; ♀, Muthambi River, Ndya, 12th January, 1899.

[1] This proves to be a well-known species of *Crenis*, which occurs also in South Africa.—A. G. B.

The female, though in excellent condition, was caught by Bvalamkombi, one of Mr. Crawshay's native servants.

6. Precis elgiva Hewits.

♂, ♀, Muthambi River, Ndya, 7th January, 1899.

7. Precis natalica Feld.

♀, Muthambi River, Ndya, 13th January, 1899.

"Fairly plentiful; but this is, I think, the only perfect specimen I have seen" (*R. C.*).

8. Hypolimnas misippus, var. inaria Cram.

♀, Muthambi River, 4500 feet, Ndya, 11th January, 1899.

9. Crenis boisduvalii Wllgr.

♂ ♂, Muthambi River, 4500 feet, Ndya, 12th January, 1899.

"An insect which I should probably never have seen, and certainly not taken, had it not been for the putrefying crocodile's head, on which it descended as it were from the clouds. It is worthy of note that this insect shows a lovely tinge of purple or blue on the inside of the wings if these are viewed at an angle in a good light." (*R. C.*)

10. Crenis howensis Staud.

♂ ♂, Muthambi River, 12th January, 1899.

"The most restless, active, and difficult insect to take I have ever come across; for six days have I been watching and following the movements of some half-dozen in the glade of fig-trees in which I am encamped, trying all I could to take one, but without success. They flip about amongst the trees and occasionally perch on the trunk and branches, but always out of reach. By great good luck this morning two have been tempted to come down and feed on a putrefying crocodile's head, and I was thus enabled to take them." (*R. C.*)

One specimen (a male) is said to have contained a whitish-green ovum, but this must have been an error of observation, as the insect has strongly pronounced male claspers.

11. Hamanumida dædalus Fabr.

"Plentiful enough on undulating plains N. of Tana River, 4200 feet, 14th January, 1899."

A single dry-season male of this abundant species.

12. Neptis agatha Cram.

♀, ♂, Muthambi River, 4500 feet, Ndya, Kikuyu, 6th & 7th January, 1899.

13. Neptidopsis ophione, var. velleda Mab.

Muthambi River, 4500 feet, Ndya, 6th & 13th January, 1899.

Mr. Crawshay appears to have seen three examples of this

species on the 6th January, of which he caught two then, and the third a week later.

14. Byblia ilithia Drury.

Wet phase.—Machakos to Neugia, 16th December, 1898.
Intermediate and dry phases.—Neugia, 31st January, 1899.
"Quite the commonest butterfly hereabouts these days; indeed I have never anywhere else seen this insect in such numbers" (*R. C.*).

15. Acræa cabira Hopff.

Clue to exact locality and date lost.
An example leading to the variety *A. apecida*.

16. Acræa lycia Fabr. (vars. *sganzini* and *daira*).

Muthambi River, Ndya, 7th & 11th January, 1899.

17. Acræa onerata Trim.

♂ ♀ *in copula*, Neugia, Kitwi, 11th February, 1899.
The sexes are remarkably alike, the wing-borders of the female slightly heavier and the body spotted.

18. Acræa acrita, var. pudorina Staud.

♂ ♂, Neugia, Kitwi, 16th February, 1899.

Lycænidæ.

19. Lachnocnema bibulus Fabr.

Ndya, Kikuyu, 4500 feet, 6th January, 1899.

20. Axiocerses harpax Fabr.

♀, Kitwi, 18th January, 1899.
"Grass-green ova" (*R. C.*).

21. Teriomima pallida Trim.

E. of Athi River, about 4300 feet, 18th December, 1898.
Mr. Crawshay regarded this as a worn example of *T. hildegarda*, to which it certainly is very closely related, but the small and inconspicuous spots on the under surface of the secondaries give it a somewhat different aspect; it would not surprise me to find that it was only another variety of that variable species. Mr. Crawshay says he took it for a moth until it was in the killing-bottle.

22. Catochrysops peculiaris, var., Rogenh. (Plate LXX. fig. 1.)

♀ ♀, Neugia, Kitwi, 24th & 29th December, 1898.
Of the first example Mr. Crawshay writes—"A hardly won capture. Caught in my Terai hat when out shooting, and kept under this on the ground, while I covered my head from the

blazing sun until my net reached me, fully three quarters of an hour."

The two specimens are of much interest, as they clear up one of the greatest muddles which has been made over any species of *Lycænidæ*:—In 1891 Rogenhofer described a butterfly which was quite unknown to English entomologists under the name of "*Chrysophanus peculiaris*"; naturally nobody expected a *Catochrysops* to be called a *Chrysophanus*. In 1892 Dr. Holland described the same species in the 'Entomologist' under the name of *Lycæna perpulchra*; in 1893 I described a male from Wasin and a female from the Victoria Nyanza as *Castalius hypoleucus*; and in 1894 Mr. Trimen described *C. peculiaris* again under the name of *Lycæna exclusa*. Dr. Holland subsequently pointed out that *C. hypoleucus* and *L. exclusa* were synonymous with his *L. perpulchra*. In 1898 Mr. Trimen received some large examples from Mashunaland which he rightly stated to be identical with our Nyanza female; but instead of adopting my name for this form, he called it *Lycæna gigantea*, stating that I had confounded the female with that sex of *L. perpulchra* (entirely overlooking the fact that the Nyanza female was described by me as the type of that sex of *Castalius hypoleucus*). At the commencement of the present year, when working out the species of *Chrysophanus*, I recognized *C. peculiaris* Rogenh. as the oldest name for the present species, and entered it in my paper on Mr. Crawshay's last collection. Professor Aurivillius also recognized Rogenhofer's species in his 'Rhopalocera Æthiopica,' where, however, he retained Mr. Trimen's name for the larger form, ignoring the fact that my female unquestionably takes priority.

The two examples now sent home by Mr. Crawshay are quite intermediate in character between the large and small forms, the colouring of the upper surface agreeing most nearly with *C. peculiaris* ♀, the expanse of wing being nevertheless equal to that of my Victoria Nyanza female. Like the latter and a worn and faded female from Zomba (which Trimen refers to as the Nyasa female), they have from one to two extra black spots in the discal series on the under surface of the primaries; the black discocellular spot is smaller than in the little Zomba female, but varies in size in the two examples. It is absolutely impossible to say that these examples belong to one form rather than to the other, and I do not doubt that they represent an intermediate phase between *C. hypoleucus*=*gigantea* the wet phase, and *C. peculiaris* the dry phase, of one and the same species.

23. Azanus natalensis Trim.

♂, Tana River, 3800 feet, 16th January, 1899.
"The only specimen seen" (*R. C.*).

24. Azanus zena Moore (*Lycæna maculenga*, Trim.).

♂, Kitwi, 4000 feet, 30th December, 1898.

25. Everes kedonga Grose-Smith. (Plate LXX. fig. 4.)

♂ ♂, Plains N. of the Tana River, Kikuyu, 5th January, 1899.

Mr. Crawshay sent us the female of this extremely pretty species in his last collection (see P. Z. S. 1899, pl. xiv. figs. 3, 3 *a*).

26. Tarucus plinius Fabr.

♀, Athi Valley, 16th December, 1898; ♂, Ndya, 4500 feet, Kikuyu, 16th January, 1899.

Of the female Mr. Crawshay observes—"Common, and all evidently newly emerged."

27. Zizera knysna Trim.

♀, Slopes of Nthatha Hill, 4700 feet, Kitwi, 31st December, 1898; ♂, ♀, Muthambi River, 4500 feet, Ndya, 8th & 10th January, 1899.

28. Zizera gaika Trim.

♂ ♂, Tana River, 3800 feet, 2nd January; Neugia, Kitwi, 7th February, 1899.

Of the second example Mr. Crawshay observes—"The smallest butterfly I have ever seen." It is a starved specimen.

29. Lycænesthes amarah Lefèb.

♀, Slopes of Nthatha Hill, Kitwi, 4700 feet, 31st December, 1898; ♂ ♂, Plains N. of the Tana River, 5th January, Tana River, 3800 feet, 16th January, 1899.

30. Cacyreus lingeus Cram.

♂ ♂, Clue to exact locality and date lost.

31. Phlyaria virgo Butl.

♀, Muthambi River, 4500 feet, Ndya, 10 January, 1899.

"The only specimen I have seen in these parts, and like, if not identical with, another which I used to take in the mountains of Nyika" (*R. C.*).

According to Prof. Aurivillius this is the female of the West Coast *P. heritsia*, but some of the details of marking make me hesitate to accept this dictum until I have seen East-African males. In my opinion the border of the secondaries is too narrow and the markings on the under surface of these wings too feeble for *P. heritsia*: I may prove to be wrong, but I very strongly object to putting species together by guess.

32. Chloroselas azurea, sp. n. (Plate LXX. figs. 2, 3.)

Intermediate between *C. tamaniba* from Suakin and *C. esmeralda* from Somali-land; evidently nearest to the former. It is considerably larger than *C. esmeralda*, the shot-colouring on the upperside of the wings being glistening deep sky-blue instead of emerald shaded with blue: in the primaries this colouring is restricted to the outer half of the internal area and the internal margin nearly

to base; the remainder of these wings is smoky brown, slightly cupreous, with a large ill-defined but distinctly darker patch over the end of the cell: secondaries cupreous brown, brilliantly glossed with sky-blue between the second subcostal branch and submedian vein; a conspicuous orange anal spot between two short tails: anal lobe small, silver-spotted and fringed with black; body blackish; frons silvery whitish, collar with pale edges; antennæ annulated with white, the club externally edged with tawny: under surface pale fleshy buff, with the discoidal area of the primaries and the anal patch of secondaries orange-ochreous; the internal area of the primaries blackish grey towards the base, white slightly opalescent beyond, the marking on the wings much as in *C. esmeralda*, silver with black margins; body below white. Expanse of wings 26 millim.

The female is rich copper-brown with white fringes, and an orange spot on the secondaries between the tails, as in the male; the under surface similar to that of the male: size uniform.

♂, Slopes of Nthatha Hill, Kitwi, 4700 feet, 31st December, 1898; ♀, Plains N. of the Tana River, 4500 feet, Kikuyu, 5th January, 1899.

C. tamaniba, according to Walker, expands one inch and one line (or 28 millim.), and is therefore the largest species in the genus; the primaries are described as being shot with blue at the base and on the hind half, and the secondaries as blue, with a narrow brown border; "an orange spot adjoining the *tail*, into which it extends, bordered on the outer side with glittering chalybeous." These characters do not at all correspond with those of *C. esmeralda* (which Prof. Aurivillius has unaccountably placed as a synonym of it), and differ considerably from those of the present species. Many years ago (1870) I saw the type, but I cannot pretend to remember exactly what it was like. I am, however, quite certain that Walker's measurement is rather under than overstated: the specimen is, of course, incorrectly described as a female. *C. esmeralda* not only differs from *C. pseudozeritis* in having only one tail to the secondaries, but in the absence of the brown clouding on the under surface of these wings. It is mere guesswork to suppose that a small insect like this from Natal is at all likely to be identical with one from Somali-land, or even that the latter is likely to be the same as one from the western shore of the Red Sea. It is quite possible that there are many species of *Chloroselas* scattered over Africa, and that, ten years hence, the species hitherto confounded will be generally regarded as amongst the best marked of all. Structurally, the species may at present be separated by the tails of the secondaries as follows:—

Species with two tails.
Small—*C. pseudozeritis* Trimen.
Large—*C. azurea* Butler.

Species with one tail.
Small—*C. esmeralda* Butler.
Large—*C. tamaniba* Walker.

But in many respects the two small species and the two large species are more nearly related to each other respectively in other characters—the bluer shot and the internal position of the blue colouring, as well as the more conspicuous anal orange spot of the secondaries, being characteristic of the larger species, the greener shot and the basal position of the greenish colouring, as well as the less conspicuous anal orange-tinted spot of the secondaries, of the smaller species.

33. Myrina ficedula Trim.

♂, Neugia, Kitwi, 22nd December, 1898.

"Taken sitting on an outstanding branch of a small tree about noon in the hottest possible sun" (*R. C.*).

34. Virachola antalus Trim.

♂, Neugia, Kitwi, 22nd January, 1899.

35. Virachola derona? Smith.

E. of Athi River, some 4300 feet, Kitwi, 18th December, 1898.

"I have no recollection of having taken this insect before. It was most accommodating too in awaiting about a quarter of an hour. I was stalking a Hartebeeste and my net was behind." (*R. C.*)

This appears to correspond with Mr. Grose-Smith's description, but it is a somewhat faded example.

Papilionidæ.

36. Mylothris agathina Cram.

♂ ♂, Muthambi River, 4500 feet, Ndya, 7th & 10th January, 1899.

37. Nychitona medusa, var. alcesta Cram.

♂, Tana River, 3850 feet, 4th January, 1899.

38. Colias electra, var. edusa Fabr.

Ndya, 8th January, 1899.

"The first specimen of *C. edusa* I have seen since leaving Massai" (*R. C.*).

39. Terias senegalensis, var. bisinuata Butl.

♂, Tana River, 4th January, 1899.

40. Teracolus calais Cram.

♂, Kitwi, 19th January, 1899.

"An average specimen of this species as regards size" (*R. C.*).

41. Teracolus eris Klug.

♂ ♂, Athi Valley, 4000 feet, 16th December, and Msokani, Kitwi, 20th December, 1898.

Of the first specimen Mr. Crawshay writes—"By no means

common: an active and exceedingly restless insect of strong flight—very difficult to take if once missed." Of the second specimen, however, he writes—"Newly emerged, evidently an easy prey in the wet and cold of early morning." This, then, is clearly the time to secure it.

As might have been expected, the males are referable to the typical Northern species, not to the more southerly *T. opalescens*. To anyone with a correct eye for outline, the pattern of the primaries in these local forms is absolutely different, apart from all minor differences of colouring; but the training of a lifetime is insufficient to enable some men to appreciate the most marked modifications of outline.

42. Teracolus increetus Butl.

Intermediate phase.— ♀, Athi Valley, 4000 feet, 16th December; ♂ ♀, Athi escarpment, eastern side, Kitwi, 18th December; ♀, Msokani, 20th December, 1898; ♂, Tana River, 3800 feet, 16th January, 1899.

Dry phase.—♂, ♀ ♀, Tana River, 3800 feet, 16th January, 1899.

Mr. Crawshay says of the male—"Very plentiful just here (Athi Valley): this and the following taken in numbers when playing together, with one stroke of the net." Of the female he says—"An insect I have never before taken, and which, until settled, I imagined to be another, rather common just here—plain sulphur with an orange tip." In this conjecture Mr. Crawshay was quite correct.

43. Teracolus xanthus, var. metagone Holl.

♂, Tana River, 3800 feet, 16th January; ♀, Neugia, Kitwi, 30th January, 1899.

♂. "Fairly common, frequents the more open country, dry and desert-like, and covered with thorny scrub" (*R. C.*).

This is distinctly a dry-season phase, and differs from *T. xanthus* var. *comptus* in the entire absence of the internal grey streak on the primaries.

44. Teracolus antevippe Boisd.

♂, var. *subvenosus*, Kitwi, 18th January, 1899.

45. Teracolus gavisa Wallgr.

♀, Kitwi, 19th January, 1899.

46. Teracolus callidia Grose-Smith.

♂ ♂, *Intermediate and dry phases.*—Tana River, 3800 feet, 16th January, 1899.

"Fairly plentiful; but, if once missed, by no means an easy insect to take" (*R. C.*).

The typical orange form of this species is by no means too well represented in the Museum series.

47. Teracolus catachrysops Butl.

♂, Msokani, Kitwi, 20th December, 1898.

"Fairly common, but not an easy insect to take: a fast flier and a desperate doubler" (*R. C.*).

The single example sent belongs to the wet phase, which differs from the dry phase in the better defined, browner, and much darker bands on the under surface. This character, apart from other differences, amply serves to prove its entire distinctness from *T. mutans* of Southern Africa, whilst at the same time it indicates some relationship to *T. protomedia*.

48. Belenois severina, Cram.

Tana River, 4th January, 1899.

Rather a curious male, having a wet aspect on the upper surface, but the under surface characteristic of a late intermediate phase, the black veins being feebly indicated.

49. Belenois mesentina Cram.

♀, Nthatha Hill, Kitwi, 4700 feet, 31st December, 1898; ♂, Neugia, 30th January, 1899.

50. Belenois westwoodi Wllgr.

Tana River, 4th January, 1899.

51. Pinacopteryx astarte, sp. n. (Plate LXX. figs. 6, 7.)

The wet phase of this species, of which we received a male from Fwambo in 1897, is not very unlike that sex of *P. falkensteinii*, but has the costal margin of the primaries shorter and the outer border more interrupted, represented only by spots at the extremities of the first and second median branches; the costal margin of the secondaries below is deep orange. Expanse of wings 60 millim.

The intermediate phase, of which (as well as of the male dry phase) we received sexes in 1889 from Tanganyika, differs in the reduction of the width of the outer border in the male and the paler under surface. The female is bright orange, redder at the base; the primaries with a marginal series of rather large greyish spots becoming black externally, and a similar smaller spot on the disk beyond the middle of the second median interspace; the secondaries with smaller black marginal spots at the extremities of the nervures: below, all the spots are small and black, and there are five tiny squamose spots across the disk of secondaries parallel to the outer margin: body blackish above, whitish below. Expanse of wings, ♂ 63 millim., ♀ 61 millim.

The dry phase (now sent by Mr. Crawshay) is smaller; the marginal blackish border of the male primaries is reduced to more or less connected spots, the number of black spots on the secondaries is reduced, and on the under surface those of the primaries are absent, whilst the orange costal border of the secondaries is

reduced to less than half its width. The female differs in the same way, but retains its vivid orange colouring. Expanse of wings, ♂ 56–60 millim., ♀ 54 millim.

♂ ♂, ♀, Tana River, 3800 feet, 4th & 16th January, 1899.

Of the male Mr. Crawshay writes—"Plentiful on a bush with a red flower, where I could have taken any number in season; but nowhere else have I seen this insect." This is probably the Eastern representative of *P. pigea*. [An allied species of *Pinacopteryx* common in the same country, but hitherto identified with *P. orbona*, is described below [1].]

52. PINACOPTERYX SPILLERI Staud.

♂ ♂, Tana River, 3800 feet, 4th & 16th January, 1899.

In Staudinger's figure the under surface of the secondaries is represented as unspotted; this is the case with the single example taken on the 4th January; all the others have a series of grey spots across the disk; the tint of these wings below varies from sulphur- to butter-yellow.

From Mr. Crawshay's note it appears that this was taken in company with *P. astarte* on the same red-flowered bush on the river's bank whilst he waited for his men to find a crossing to the other side.

53. PINACOPTERYX GERDA Grose-Smith & Kirby.

Intermediate phase.—♀ (shattered), Muthambi River, 4500 feet, Ndya, 10th January; ♂ (perfect), Tana River, 16th January, 1899.

Dry phase.—♂ (shattered), Muthambi River, 6th January; ♀ (perfect), 11th January, 1899.

Of the first female Mr. Crawshay writes—"Oblong ova, of a greenish-yellow colour"; of the second one—"A perfect specimen at last! The first I saw of this species was on the wet mud of the Tana River, where—when waiting for my net—it was devoured by a dragonfly; the second and third which I took are both rags. Greenish-white spike-shaped eggs."

Professor Aurivillius questions the distinctness of this species from *P. simana*, and suggests that the latter may be a seasonal

[1] PINACOPTERYX VIDUA, sp. n. (Plate LXX. figs. 8, 9.)

Allied to *P. orbona*, which it represents in Eastern and Northern Africa: it has well-defined seasonal phases, the wet phase being most like *P. orbona*; the male, however, has a narrower marginal border to the primaries; the apex of these wings and the secondaries creamy on the under surface, instead of white: the female shows far less grey basal shading, not filling the discoidal cell; the discal spots are wanting from the secondaries, and the orange from the under surface of the primaries (which is characteristic of *P. larima*, the female of *P. orbona* in my opinion, not of *Belenois thysa*). Expanse of wings, ♂ 45–46 millim., ♀ 46–50 millim.

♂ ♂, White Nile, Fóda (*Emin*), and British East Africa (*Gregory*); ♀ ♀, Wasin, and British East Africa (*Gregory*).

Formerly I referred this species to *P. ortygna* (*cf.* P. Z. S. 1888, p. 76), see Aurivillius, Rhop. Æthiop. p. 411. It is certainly not *P. gerda*, which is more nearly related to *P. simana*.

form of *P. charina*. I am quite sure that all collectors of South-African species will dissent from his last suggestion, because the wet, intermediate, and dry phases of *P. charina* are well known, and (apart from size) can readily be distinguished from *P. simana* by the uniform character of their upper surface at all seasons, and by the absence of the black veins on the upper surface and the black discal spot on the under surface of the male primaries. We do not possess the wet phase of *P. gerda*, in which the outer border attains to a width of 4 millimetres; but even the intermediate phase has a wider border than the wet phase of *P. simana*; and in all the specimens now received the grey at the base of the primaries is rather more diffused and the black veins are obliterated almost to the outer margin, bringing the species nearer to *P. charina* excepting for the black discal spot of the male and the absence of the dense speckling which characterizes the dry phase of the Natal species; the primaries in *P. gerda* are somewhat shorter, and therefore less acutely triangular, than those of *P. simana*.

Before leaving *Pinacopteryx* it is perhaps as well to point out that "*Ixias venatus*" proves to be a female of a species undoubtedly referable to this genus, and apparently most nearly related to *P. liliana*; it certainly has nothing to do with *Belenois*.

54. Herpænia melanarge, var. iterata Butl.

♀, Kitwi, 18th January, 1899.

"Dark yellow ova" (*R. C.*).

55. Papilio antheus, var. utuba Hamps.

Tana River, 3800 feet, 3rd January, 1899.

"This, a poor specimen rather, is one of only two seen here in as many days" (*R. C.*).

56. Papilio nireus Linn.

♀, Undulating plains N. of Tana River, 4200 feet, 14th January, 1899.

"By no means plentiful; the second or third only I have seen" (*R. C.*).

Hesperiidæ.

57. Sarangesa eliminata Holl.

E. of Athi R., some 4300 feet alt., Kitwi, 18th December, 1898.

"Undulating uplands, timbered with thorny scrub and very dry. This is, I think, an insect very familiar to me in British Central Africa."

Mr. Crawshay obtained examples of this species at Machako's, in British East Africa, but not in Nyasa-land; he is probably thinking of *S. synestalmenus*.

58. Eretis djælælæ Wllgr.

Clue to exact locality and date lost.

59. Abantis paradisea Butl.

Tana River, 3800 feet, 16th January, 1899.

"Taken on a flowering shrub in one of the hottest places and under one of the hottest suns I have ever experienced" (*R. C.*).

60. Pyrgus colotes Trim., var.

♂ ♂, Kangonde, 4500 feet, Kitwi, 31st December, 1898.

"Taken when playing together, with a single stroke of the net" (*R. C.*).

These examples are blacker above and browner below than Angolan specimens, but they are spot for spot alike in other respects.

61. Gomalia elma Trim.

Muthambi River, 4500 feet, Ndya, 12th January, 1899.

"An insect new to me; taken in the early morning on the flags growing on the river's bank" (*R. C.*).

Mr. Crawshay obtained this insect previously at Kikuyu and Ngongo in July and August, but it is impossible for anybody to remember every obscure little thing that has passed through his hands; it surprises me that Mr. Crawshay remembers so many.

62. Acleros mackenii Trim.

♂ ♂, Muthambi River, 10th & 16th January; ♀, 12th January, 1899.

♂. "Quite a new insect to me." ♀ ? "No doubt the other of the pair which I saw of which I took the one five or six days ago in precisely the same spot—in a cool glade in my camp close to the stream. I have meantime each day visited the same place in the hope of securing the other insect, but without success until now."

♀. "Taken in the early morning on the banks of the stream about twenty yards from the spot where I took the pair" (*R. C.*).

Either the white spots on the primaries are sometimes almost obliterated on the female or the example taken on the 16th January is a male; it, however, has the white border of the secondaries almost entirely restricted to the fringe; the body having been squeezed out I cannot be sure that claspers are present. In my opinion it is a female (as Mr. Crawshay evidently believed), but an aberrant one.

63. Andronymus philander Hopff.

Muthambi River, 11th January, 1899

64. Padraona zeno Trim.

Muthambi River, 3rd January, 1899.

♀. "Containing two rather large yellow spherical ova. The only specimen of this species which I have seen" (*R. C.*).

65. Gegenes letterstedti Wllgr.

♂, Muthambi River, 7th January, 1899.

66. Baoris auritinctus Butl.

♂, Tana River, 3800 feet, 16th January, 1899.

"Taken in my two hands and then manipulated so as to enable me to transfix it with a thorn, after which I was able to administer the necessary pinch" (*R. C.*).

67. Baoris maranga, sp. n. (Plate LXX. fig. 5.)

Not nearly related to anything known to me. Wings deep smoky brown; the male with three unequal streaks of bronze-brown only visible in certain lights, divided by the median vein with its first and second branches; fringe towards anal angle of secondaries and anal tuft paler: wings below slightly more silky than above; primaries with an oblique series of three whitish dots beyond the cell; secondaries with a central patch slightly paler than the ground-colour. Expanse of wings 32 millim.

The female chiefly differs in having five transparent spots in the primaries—three in an oblique series beyond the cell (answering to those on the under surface of the male), and two placed obliquely near the base of the median interspaces; fringe towards anal angle of secondaries and anal tuft whitish. Expanse of wings 34 millim.

Muthambi River, 4500 feet, Ndya, 7th & 10th January, 1899.

Of the male Mr. Crawshay writes, "A new *skipper* to me;" and of the female, "Greenish-white spherical ova."

This species, though unlike any other African species that I have seen, either in collections or plates, and unrecognizable in any published description that I have met with, is perhaps more nearly related to *B. alberti* than to any other known species.

68. Rhopalocampta anchises Gerst.

♀, Bondoni Plains, 5400 feet, 8th December, 1898.

In the present collection Mr. Crawshay unfortunately did not follow his usual plan of putting the exact locality on every envelope, but in some instances referred to a number; thus:—See no. 166, 125, or 146, place and date. Not being at all prepared for this, I took no special note of these collector's numbers until I came to one of the notes, by which time no. 166 had been incorporated and I had lost all clue to it; the others I happily found: this will account for the absence of exact localities and dates for several species, they are all referred to no. 166 (cf. *Acræa cabira*, *Cacyreus lingeus*, and *Eretis djælælæ*).

One other species was obtained by Mr. Crawshay—a possibly new *Ypthima*,—but in such a shattered condition that it is neither fit for description nor for the collection; it is also referred to the unlucky number.

EXPLANATION OF PLATE LXX.

Fig. 1. *Catochrysops peculiaris*, ♀ (intermediate phase), p. 965.
2, 3. *Chloroselas azurea*, ♂ ♀, p. 967.
4. *Everes kedonga*, ♂, p. 967.
5. *Baoris maranga*, ♂, p. 975.
6, 7. *Pinacopteryx astarte*, ♂ ♀, p. 971.
8, 9. „ *vidua*, ♂ ♀, p. 972.

6. On a small Collection of Butterflies from the Nandi District, Uganda Protectorate, Eastern side of Lake Victoria; made by Captain Hobart, of the Grenadier Guards. By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c.

[Received November 1, 1899.]

The collection of which this is an account is small but interesting, the whole of the specimens having been captured by Capt. Hobart on the march. Among them is a *Cymothoe* which appears to be quite new, and of considerable interest from its affinity to Western forms; also *Planema poggei* ♂, and *Acræa leucographa*, an extremely beautiful variation of the Western *Acræa admatha*.

Nymphalidæ.

1. Amauris albimaculata Butl.

The white spots on the primaries are reduced in size in all the specimens, but we have similar examples in the Museum collection.

2. Charaxes candiope Godt.

One male example.

3. Cymothoe hobarti, sp. n.

The male above vermilion suffused with carmine, the costal and outer margins narrowly black; primaries with a small apical patch and one subapical spot, sometimes continued indistinctly as a submarginal series; secondaries with well-defined submarginal black spots commencing with a sagittate spot at apex and terminating in an obtusely biangulated linear marking above anal angle; abdominal border pale brown; body bronzy brown, the palpi and under surface of antennal club tawny. The under surface is of a sandy-brownish hue, with fleshy and weak olivaceous changeable tints; the general pattern is that of *C. uselda*, the markings on the basal half being sharply outlined in black; the nearly straight dividing line beyond the middle is dark rich brown in the type, but weakly defined in a second smaller male; the series of **A**-shaped markings beyond the dividing stripe are alternately pale pearly pink and olivaceous greyish, the outer series of the latter tint uniting into a continuous wavy submarginal line dotted with blackish between the nervures; the femora are whitish. Expanse of wings 42 to 58 millim.

The female nearly resembles that sex of *C. adela*, excepting that the basal area is internally suffused with olivaceous greyish and externally with pale sandy yellowish, the discal series of sagittate markings is weaker in the primaries and very much more so in the secondaries; on the under surface the general appearance is

even closer to that of *C. adela* ♀, but the central stripe is straighter and very dark, with the irregular series of spots which bound it internally white, the outer border (excepting at its extremities) sandy brown, and the discal markings very indistinct. Expanse of wings 64 millim.

Two males and one female were obtained.

4. Precis aurorina Butler.

A female (very much shattered) of an example in which the tawny band crossing the wings is nearly half as wide again as usual. If this should be proved to be a constant difference in Uganda specimens, it would be necessary to regard them as representing a distinct local race.

5. Precis cebrene Trimen.

Two males.

6. Precis boopis Trimen.

One shattered male.

7. Precis gregorii Butler.

A pair in poor condition.

8. Cyrestis elegans Boisd.

A much shattered specimen.

9. Eurytela hyarba Fabr.

Two examples.

It is difficult to decide whether these Eastern examples should be assigned to typical *E. hyarba* or var. *angustata*; they seem to vary as regards the width of the white band.

10. Vanessula milca Hewits.

An example with an unusually broad tawny band, remarkably resembling the female of *Precis aurorina* in the same collection excepting in size.

11. Planema latifasciata E. M. Sharpe.

Two males.

This is new to us.

12. Acræa admatha, var. leucographa Ribbe.

Two males.

This is an extremely pretty local race of the species, which Capt. Hobart assures me was quite common.

Papilionidæ.

13. Nychitona medusa, var. immaculata Auriv.

One male.

14. TERIAS SENEGALENSIS, var. BISINUATA Butler.
One female.

15. BELENOIS MESENTINA Cramer.
A pair.

16. GLUTOPHRISSA SABA, var. CONTRACTA Butler.
One male.

17. LEUCERONIA THALASSINA Boisd.
One male.

7. Note on the Habit and Mode of Growth of the Corals belonging to the Genus *Pleurocorallium*. By JAMES YATE JOHNSON, C.M.Z.S.

[Received November 2, 1899.]

In my communication to the Zoological Society on the *Coralliidæ* of Madeira (P. Z. S. 1899, p. 57) nothing was said as to the cause or meaning of the peculiar habit and mode of growth of the four known species of *Pleurocorallium*. Whilst the species of *Corallium*, such as the red coral of the Mediterranean, branch in all directions and put forth their polype-cells on all sides of the branches, the *Pleurocorallia* ramify more or less in one plane and their polype-cells are confined to one face of the branches.

When Dr. Gray first alluded to the matter (P. Z. S. 1867, p. 125) he said, "I have no doubt that it (the coral under description) grows out horizontally from the rocks, and that they (the polype-cells) arise from the upper surface of the branches." This would appear to have been only a conjecture; but in his Catalogue of Lithophytes or Stony Corals in the British Museum (p. 24) he went further, and described them as "growing horizontally from the sides of rocks," without citing any authority for the statement. The facts about to be mentioned seem to throw doubt on the correctness of Dr. Gray's view, and to suggest another conclusion.

In describing the only known specimen of *Pleurocorallium maderense* (*loc. cit.*), I stated that some zoophytes of rare occurrence at Madeira were growing parasitically upon it. Two of these were branched specimens belonging to the genera *Suberea* and *Stenella*, and they were seated on different parts of their host at a distance from each other. The point to which I wish to draw attention is, that both these Alcyonarians had grown in the plane of the host. If that had extended horizontally, they too had extended horizontally. But can we suppose it possible that they would take in

growing any direction other than a vertical one, whatever might be the position of the coral on which the embryos had settled? May we not hold it as certain that they had grown upright, that is towards the surface of the sea? If so, the *Pleurocorallium* must have taken the same direction.

Another piece of evidence having the same bearing is afforded by some specimens of a simple Madreporarian coral (*Desmophyllum*). All four examples were attached by their bases to the front of the coral, but two of them had twisted themselves round and had pushed their calyces between its branches to the other, that is the posterior side. It is not probable that the *Desmophylla* would have acted so if the supporting coral had possessed a horizontal position, because their calyces would then have been directed downward to the bed of the sea.

Again, it is observable that in a specimen of another species of *Pleurocorallium* in my possession where a small branch by some accident had been broken off the living coral, it had fallen upon the spreading base, to which it had in course of time been made to adhere by an extension of the growing cœnenchyma of the base. It is not easy to understand how the fractured branch could have lodged upon the base in the manner it has done unless the coral had been upright.

In view of these facts, I do not see how we can adopt Dr. Gray's hypothesis, however plausible it may appear at first sight, or come to any other conclusion than that these corals assume in their growth a vertical, not a horizontal position. But if this is so, what is the meaning of the fact that the polype-cells are confined to one face of the branches? If we suppose that the habitat of the corals is in that part of the sea's bed where a constant current is flowing, it is clear that it would be more beneficial to the colonies if all their polypes were turned towards the direction from which their food comes, than if half of the polypes were turned in the opposite direction. A colony will obviously obtain the largest possible supply of nutriment when all its members face the current that carries it, we may say, into their mouths.

To summarize what has been said: in order to account for the fan-like mode of growth of the *Pleurocorallia* and the unilaterality of the polype-cells, Dr. Gray maintained that the corals grow in a horizontal position. As such a position is not easily reconciled with the facts above stated, the suggestion is now put forward that the corals grow upright in the path of a submarine current with all their polypes opposed to the on-coming stream.

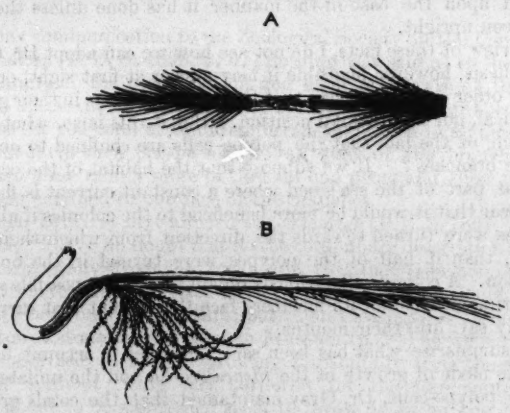
8. Further Notes on the Moult of the King Penguin (*Aptenodytes pennanti*) living in the Society's Gardens. By W. E. de Winton, F.Z.S.

[Received November 24, 1899.]

Some observations on the moult of the King Penguin were offered by me in November 1898 (see P. Z. S. 1898, p. 900). I am now able to supplement those notes by further important particulars, the same bird, still alive and well in the Society's Gardens, having again gone successfully through the moult.

The dates given for last year were again closely adhered to, and the succession of changes were made pretty much in the same order; but I am able now to explain fully the very strange appearance of the old feathers, which were then likened to withered leaves. The coloured portion of the sheath of the bill was shed as before.

An examination of the freshly moulted feathers showed that the bases were unlike those of the feathers of any other bird so far as I am aware.



Feathers of *Aptenodytes pennanti*.

A. Part of new feather of flipper, with old feather still attached.
B. Moulted breast-feather, showing flexible sheath attached to its base.

The quill does not end sharply with a contracted base, but is shed with a flexible sheath attached to it (fig. B). This sheath, which is a continuation of the outer coat of the quill, is, in the body-feathers, as long as the naked part of the shaft. On handling the bird it was found that its enlarged puffed-out appearance at the beginning of the moult arose from the old plumage being actually raised, and now adhering only to the new feathers that were growing *into the*

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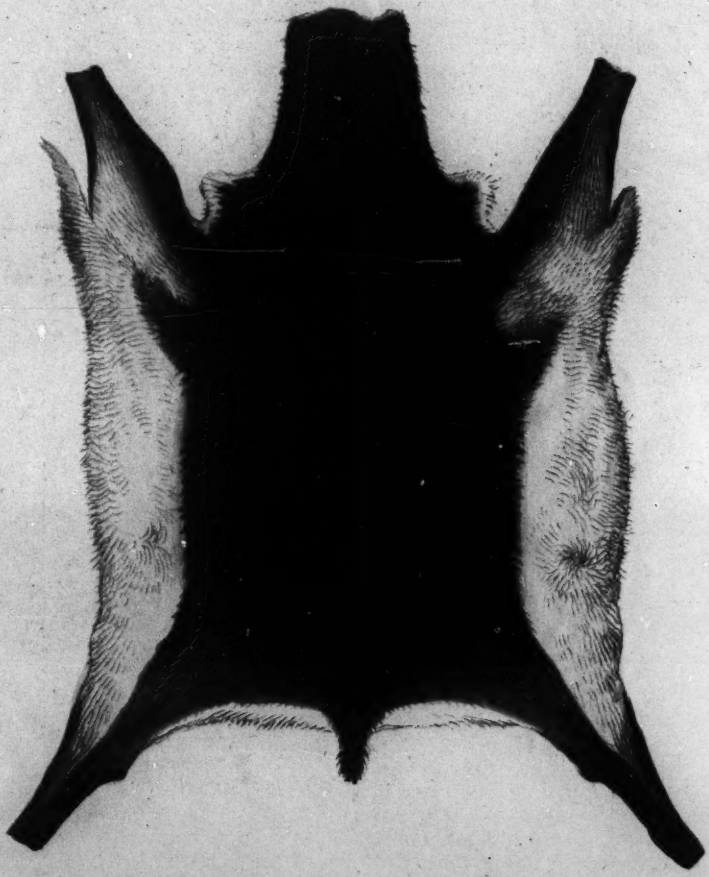


J.Smit del. et lith. Mintern Bros. imp.

SKIN OF SMITHEMAN'S KOB.
(Cobus smithemani.)

bases of the old ones, the thin sheaths attached to the bases of the feathers being occupied by the points of the new feathers.

All the feathers so raised had lost most of their original colour, or lost it entirely, the yellow feathers of the neck having bleached white, and the slate-blue feathers of the back and flippers being dull brown or drab except at the extreme tips.

The greater part of the old plumage is removed by the bird's bill as soon as the new feathers upon which it is raised are sufficiently developed to form a covering, but many feathers upon the back and flippers may be left for a longer period (fig. A); these scattered feathers, adhering to the now nearly fully developed new plumage, produce the appearance of small crinkled leaves, which puzzled me so much last year.

The small body-feathers have a large downy aftershaft; the quill-feathers have a naked shaft as long as the plumed portion.

The feathers of this bird are so unlike those of any other bird, in the entire absence of a raised midrib as well as in their umbilical portion, and the nature of the moult seems to open up such interesting questions, that I have placed all the materials possible in the hands of my friend Mr. W. P. Pycraft, who I hope will shortly publish the result of investigations which he is about to make upon these specimens.

9. Description of the Skin of an apparently new Kob Antelope from the Neighbourhood of Lake Mweru, with Note on a Skull and Horns of an Antelope of the same Genus. By R. Lydekker.

[Received November 20, 1899.]

(Plate LXXI.)

I am indebted to Mr. Rowland Ward, F.Z.S., for the opportunity of exhibiting to the Society this evening the skin of the very handsome and apparently new species of Kob Antelope forming the subject of the drawing (Plate LXXI.). The specimen, which consists of a flat skin, wanting the head, feet, and the greater portion of the tail, was obtained by Mr. F. Smitheman, F.Z.S., in the neighbourhood of Lake Mweru, situated to the south-west of the lower end of Lake Tanganyika. It arrived in England during last summer, and there were hopes that the head would follow; but if the latter was ever despatched at all, it has evidently miscarried.

The skin has the appearance of belonging to an adult animal, and there is every probability that it pertained to a male. On the under surface there are rudimentary mammæ, which indicate that the skin must be that either of a male or of a young female. If it were that of a young female, it would indicate that the adult animal was of very large size; but I think it may be pretty confidently assigned to an adult male.

From the general characters of the pelage and its coloration, and

especially from the long shaggy hair on the nape of the neck and the absence of a mane, the specimen may be confidently assigned to the genus *Cobus*. Additional evidence in favour of this reference is afforded by the circumstance that the long hair on the middle line of the back is reversed from a point some distance in advance of the loins to the withers, exactly as in the Puku (*C. vardoni*).

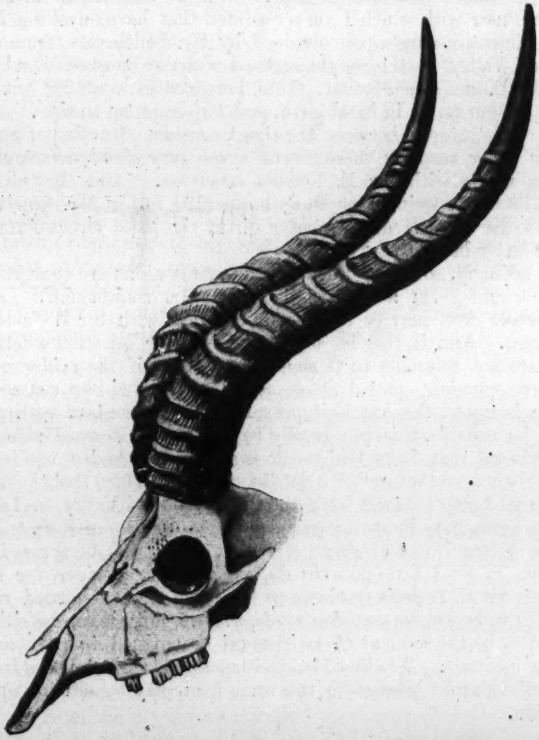
In size the animal to which the skin pertained must evidently have been considerably larger than the species last mentioned, and may have been more nearly comparable in this respect with *C. maria* of the Bahr-el-Ghazal. In colour, the nape, the sides of the buttocks, and thighs are bright chestnut-tawny; the middle line of the back, the hinder portion of the shoulders, and the hind-quarters are the same chestnut-tawny mingled with blackish brown; the fore part of the shoulder, a line on the under surface of the neck, the flanks, and the front surface of the fore-limbs and of the lower part of the hind limbs are of a deep glossy blackish brown, the under-parts being dirty white.

The portion of the skin of the neck remaining, which seems to have been cut off a considerable distance below the head, is suggestive of a comparatively long-necked animal. And if this be a correct inference, it would be natural to expect that the horns were of a comparatively long and slender type. Now, in its dark colour the skin is more like that of *Cobus maria*, of the swamps of the White Nile, which is a species with comparatively long, slender, and doubly curved horns; and it is to that animal, rather than to any other member of the genus *Cobus*, so far as the materials permit of forming an opinion, that I am inclined to consider the form represented by the skin before us most nearly related. Altogether apart from the distance between the White Nile and Lake Mweru, the skin under consideration is broadly distinguished from the male of *Cobus maria* by the absence of the white patch on the withers and the white line down the back of the neck. As regards the female of the latter species, there is a definite statement in the 'Book of Antelopes,' vol. ii. p. 122, that it is similar in all respects to the buck, except for the lack of horns; but in the plate a female is figured without the white saddle and neck-line [1].

As there is no other Antelope of which the skin is known that presents any close resemblance to the specimen under consideration, and since it is certainly distinct from the male of *C. maria* (being itself probably a male specimen), I take leave to regard it as representing a new species, for which I propose the name of *Cobus smithemani*; the skin represented in the figure (Plate LXXI.) being of course the type. The species may be provisionally defined as a large-sized Kob, differing from every other species of the genus except *C. maria*, and distinguished from the male of the latter by the absence of the white line down the back of the neck and the patch of the same colour on the withers, in which region the present species is chestnut.

[1] From a specimen that has recently come under my notice, the white neck-line does not seem to be constant even in the bucks of *C. maria*.

I may now mention another piece of evidence in favour of the relationship of this *Cobus smithemani* to *C. maria*. A correspondent of Mr. Rowland Ward writes that in the neighbourhood of Lake Mweru he has seen an Antelope very like a Situtunga, with similarly elongated hoofs, but with horns more like those of a Lechwi, although longer and slighter. Such a description would admirably fit the present species, if, as I suggest, it be more nearly allied to *C. maria* than to the Puku. Supposing it to have elongated hoofs, I should not regard such difference as, at the most, of more than subgeneric importance.



Skull and horns of Loder's Puku (*Cobus vardoni loderi*).

Before concluding this communication, I may call attention to the skull and horns of a Puku-like Antelope in the collection of Sir E. G. Loder, which I first thought might belong to the same species as the above skin. This skull and horns, of which the locality is unknown, are shown in the accompanying drawing. The

specimen is essentially of the Puku type, but broadly distinguished by the circumstance that while the skull itself is slightly shorter than that of an average-sized Puku skull in the British Museum, the horns are very much longer and stouter. In the Puku skull the length from the fronto-parietal suture to the tip of the nasals, measured in a straight line, is 8·5 inches, while in Sir E. Loder's specimen the corresponding dimension is but 8 inches. In the present specimen the horns have more ridges (17) and relatively shorter tips than any Puku horns I have seen; they measure 20·3 inches along the front curve, 8·0 inches in basal circumference, and 8·1 inches between the tips. Now the only horns assigned to the Puku with which I am acquainted that have anything like these dimensions are a pair obtained by Mr. Smitheman from the Luswesi Valley, in the neighbourhood of Lake Bangweolo, which lies S.S.E. of Lake Mweru; these horns measuring 20¼ inches along the curve, 8¼ in basal girth, and 12¼ from tip to tip[1].

The wide interval between the tips I consider of no importance, but in other respects these horns agree very closely as regards measurements with Sir E. Loder's specimen. And they differ from the next specimen of Puku horns (19⅛ in.) in Mr. Rowland Ward's list[2] by the much greater girth, the basal circumference of the latter being 6¾ inches.

Accordingly, so far as horn-measurements alone are concerned, there would seem a probability that Mr. Smitheman's Lake Bangweolo skull may be specifically identical with Sir E. Loder's specimen. And if this be so, there arises the question whether both are not referable to *C. smithemani*. But if the evidence of the correspondent quoted above as to the Lechwi-like character of the horns of the Antelope presumed to be identical with the latter be reliable, this can hardly be the case. It must also be remembered that Lake Bangweolo is a considerable distance from Lake Mweru, so that each district (in spite of the fact that the true Puku and Lechwi extend from the Chobi-Zambesi Valley to Lake Mweru) may have its own particular species or race of Kob.

The matter is one of great difficulty, and I may be accused of rashness in what I propose to do, which is to consider, for the present, Sir E. Loder's specimen as typifying a large-horned race of Puku to be known as *Cobus vardoni loderi*, until it can be either proved to be the same as *C. smithemani* or entitled to rank as a species by itself. Whether Mr. Smitheman's large Puku head from Lake Bangweolo belongs to the same form may be left an open question.

[1] See Rowland Ward, 'Records of Big Game,' p. 189 (1899).
[2] *Loc. cit.*

December 19, 1899.

Dr. HENRY WOODWARD, LL.D., F.R.S., V.P., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of November 1899:—

The registered additions to the Society's Menagerie during the month of November 1899 were 123 in number. Of these 35 were acquired by presentation, 8 by purchase, and 1 in exchange, 78 were received on deposit, and 1 was born in the Gardens. The total number of departures during the same period, by death and removals, was 110.

Amongst the additions attention may be specially directed to the two Snake-Fishes (*Polypterus senegalus*) from the River Gambia, obtained by Mr. J. S. Budgett, F.Z.S., during his recent expedition to the Gambia, and presented by him on Nov. 22nd. These are believed to be the first examples of this remarkable fish ever brought alive to Europe.

On behalf of Mr. G. S. Mackenzie, F.Z.S., a photograph was exhibited of two remarkably large tusks of the African Elephant (*Elephas africanus*) recently sold at Zanzibar, and stated to have been obtained in the district of Kilimanjaro. They each measured, on the outside curve, 10 feet 4 inches in length, and weighed respectively 235 lbs. and 225 lbs.

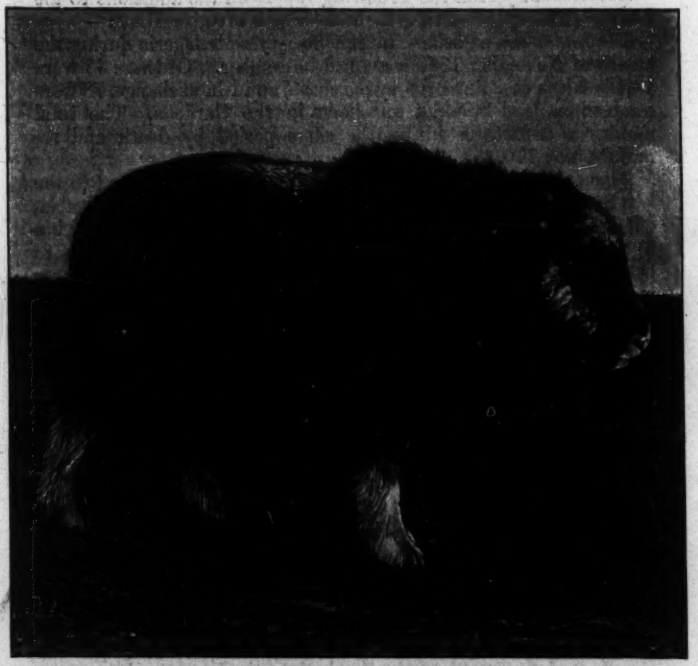
Mr. Sclater exhibited the hind portion of the skin of a Giraffe, which had been shot on the east bank of the Great Loangwa River, Northern Rhodesia, in latitude 13° South, and read the following extract from a letter on the subject addressed to him by Mr. Alfred Sharpe, dated Zomba, June 14th, 1899:—

"As you know, there have been from time to time reports of Giraffes existing north of the Zambezi on the Loangwa, but no one has been able actually to verify this until now. This skin was sent to Mpeseni's while I was there, the beast having been shot by a prospector. He stated that they were not plentiful at all, and were restricted in area, but that he had seen a herd of 35. The skin was sent down to Capt. Chichester, and was not complete, as it consisted of the hind-quarters only, but possibly this will be sufficient for determination as to whether it belongs to a different variety from the S. African Giraffe."

Mr. W. E. de Winton, F.Z.S., who had examined this specimen, was of opinion that it was decidedly referable to the Southern form (*Giraffa capensis*).

Mr. Sclater stated that during a recent visit to Woburn he had had the pleasure of inspecting, under the guidance of the President, two young male Musk-oxen (*Ovibos moschatus*) which had been

lately added to the collection. According to information kindly supplied to Mr. Sclater by Grosserer Anton Näss, of Tromsö, these animals had been captured on Clavering Island, near Cape Mary, East Greenland (about 74° N. lat.) on the 16th August, 1899.



Young male Musk-ox, living at Woburn. (From a photograph taken by H.G. The Duchess of Bedford.)

Mr. Sclater exhibited photographs of these animals taken by the Duchess of Bedford, and stated that he believed these specimens to be the first examples of this remarkable mammal that had reached Europe alive.

Mr. W. E. de Winton exhibited a remarkable Mouse of the genus *Dendromys*, obtained by Lord Lovat at Managatha in Southern Abyssinia, for which he proposed the name *Dendromys lovati*. This new species was of about the same size as *D. typicus*, but was striped to almost the same extent as the Barbary Mouse (*Arvicanthis barbarus*). Perhaps the markings would be more easily realized if likened to those of the Chipmunks (*Tamias*): the broad black dorsal stripe was divided by a narrow grizzled

central line; on either side of the black stripes were pale fawn stripes; outside these again were black stripes. The general body-colour was soft greyish brown. The fur was very soft, like that of *Malacothrix*, so that the general effect of this colouring was particularly pleasing. The tail was barely so long as the head and body, and was thickly covered with short hairs.

Mr. R. E. Holding exhibited, on behalf of Mr. William Pierpoint, a series of the horns of the Siberian Roebuck (*Capreolus pygargus*) brought from the Gulf of the Obi, Siberia, and pointed out some remarkable variations in the form and size usually characteristic of the horns of this species.

Mr. Holding also exhibited a pair of the horns of the Altai Deer (*Cervus eustephanus*) from the same district, which were mainly interesting on account of the absence of the third tine on both horns—a somewhat unusual case, as the third tine in this group of Deer is the most persistent, the "bez" tine being usually arrested.

A pair of horns, probably of the same species, also showing the third tine absent, had been shown by Mr. H. J. Elwes at a recent meeting of the Linnean Society and figured in the Journal of that Society for 1899 (Zool. vol. xxvii. p. 32).

Dr. Forsyth Major, F.Z.S., exhibited several skulls of fœtal Malagasy Lemurs, partly collected by himself and partly lent to him by the Hon. Walter Rothschild, M.P., and Prof. Charles Stewart, F.R.S., and made the following remarks:—

All the Malagasy Lemurs, *Chiromys* included, exhibit a remarkable peculiarity of their tympanic bulla, the *annulus tympanicus* taking no part whatever in its conformation. This condition is unique amongst the Mammals, if we except the Insectivorous form *Tupaia* (Winge), to which I am able to add the nearly related genus *Ptilocercus*. To decide the question whether this is a primitive condition in Malagasy Lemurs, we have in the first place to investigate how the bulla is developed. In the youngest stage available to me for examination, the fœtus of a *Chiromys*, there is no trace of an osseous bulla; the completely ossified annulus lies almost horizontally underneath the periotic. In a second stage (*Lepidolemur*) ossification begins to be developed from the lower sharp margin of the periotic, which adjoins the annulus. In a third stage (*Lepidolemur*) this outgrowth appears increased, and has a shell-like shape, with the concavity turned outward; the annulus is gradually being uplifted by it. In a fourth stage (*Lemur rubriventer*) the shell-like ossification is still more increased, and begins to cover the median part of the annulus; and this state of things is still more increased in the fifth (*Lepidolemur*) and sixth stage (*Avahis laniger*), with the result that first the median part, and eventually the remainder of the annulus becomes invisible when viewed from below, being shut by the periotic

In the adult (as will be seen by the skull of an adult *Lemur rubriventer* which I exhibit) the annulus is represented by a bony ring—the size is scarcely larger than in the youngest stages—which hangs freely in the tympanic cavity, being coalesced with the *squamosum* only in one part, viz. anteriorly to the stylo-mastoid foramen. Ontogeny thus teaches us that the annulus of the adult is not a secondarily detached part of the bulla.

In the second place, I have to state, in connection with the above, the important fact, that in the Tertiary *Adapis* the annulus tympanicus is a free ring, independent of the bulla, absolutely as in the Malagasy Lemurs. Besides, in the large development of the bulla and in the conformation of the whole of the basicranium (in the shape and position of foramina &c.), *Adapis* closely resembles the Malagasy Lemurs. So that, far from agreeing with Osborn and Wortman, who place *Adapis* among the "primitive Anthropoidea," I now see no reason for separating it as a family from Malagasy Lemurs.

In the Oriental and Ethiopian Lemurs both the annulus and an outgrowth from the petrosum enter into the composition of the bulla. In a young *Nycticebus* (which I exhibit) it is to be seen that the median part of the bulla is, as in Malagasy Lemurs, formed from an appendage of the periotic, which becomes co-ossified with the annulus; in the specimen exhibited the suture between them is distinctly visible. The annulus, in its turn, no longer plays the passive part that it does in Malagasy Lemurs, but grows out laterally, so as to form the lateral part of the tympanic cavity, which, however, never reaches the dimensions it has in Malagasy Lemurs. I have not, for the present, sufficient material to follow the process of development in detail in other Malagasy Lemurs. In the skull of a half-grown *Galago*, it may be seen that the composition of the bulla is essentially the same as in *Nycticebus*. From the close agreement in cranial characters between the last-named and *Loris* and *Perodicticus*, it may be safely argued that in the development of their bulla they also agree with *Nycticebus*. The same holds good with regard to *Tarsius*, as shown by a young skull of *Tarsius spectrum* now exhibited.

Dr. Forsyth Major also asked leave to exhibit specimens of two subfossil Mammals from Madagascar, which would be fully described later on; but he preferred not to delay their exhibition, as very soon it would probably be no longer in his power to exhibit them. Dr. Forsyth Major made the following remarks:—

This almost complete skull, together with a mandibular ramus, represents a new species of *Nesopithecus*, which may be called *Nesopithecus australis*, sp. nov. It is distinguished from *N. roberti* by its smaller size, by the less steep facial profile, by the position of the lachrymal foramen situated on the margin of the orbit, and not inside as in *N. roberti*, and by the slightly outward direction of the orbits. This beautifully preserved specimen shows that the genus *Globilemur* founded by me on the posterior, and *Nesopithecus roberti*

founded on the anterior part of a cranium, are one and the same and it further shows that the skull of *Nesopithecus* is provided with several features characteristic of the Malagasy Lemurs, amongst them being the character of the bulla before described, in which it completely agrees with them. The bullæ are very spacious, and the outer opening of the *meatus auditorius* being very large, the free tympanic ring can be seen through it without difficulty.

Other features of this remarkable skull are the following:—

The orbits are open behind. The number and notation of the teeth are the same as in *N. roberti*. In the number of the upper series the latter agrees with American monkeys, but at the same time with the Lemurinæ. In the lower series the number of premolars is as in the latter; the number of incisiform teeth is two, as in the Indrisinæ. On the other hand, several features presented by *N. roberti*, and in a minor degree by the present species, are decidedly those of the Anthropoidea, and scarcely a single one of the characters considered to distinguish the Lemuroidea from the Anthropoidea holds good in the case before us. In both the species of *Nesopithecus* the upper incisors are not separated in the median line; in their shape they decidedly resemble the incisors of the Cercopithecidæ, the lower incisiform teeth being inserted nearly vertically. The true molars, as previously stated (*cf.* Geol. Mag. 1896, p. 435), present the pattern of the Cercopithecidæ. The facial profile is steep in both species; very steep in *N. roberti*, in which the orbits are directed straight forward and the lachrymal foramen is situated inside the orbit. These resemblances to the Monkeys are not limited to the skull, but extend to almost every one of the bones of the skeleton, most of which are at hand.

As the question at present stands, we have then to inquire whether *Nesopithecus* is the most highly evolved of the Lemuroidea or the lowest of the Anthropoidea—that is to say, are its Simian characters independently acquired or not? I do not intend to enter into this difficult question this evening, as an attempt to answer it can only be made after a fuller description and discussion of all the characters.

The beautifully preserved upper molar teeth of *Megaladapis* now exhibited form part of a complete set of teeth recently received from Madagascar, and agree in all particulars almost exactly with the correspondinhg teet of *Megaladapis madagascariensis*, but they are at least one-third larger, and thus indicate a huge Lemurid, the skull of which must have had the approximate length of 330 mm. I propose to call this new species *Megaladapis insignis*.

Mr. W. L. Sclater, F.Z.S., Director of the South African Museum, Cape Town, explained the nature of a series of volumes, contributed by various authors, which he proposed to issue under the title of the 'Fauna of South Africa.' The first volume, which he hoped would be ready in a few days' time, would deal with the first portion of the Passerine birds; it had been prepared by the

late Dr. Arthur Cowell Stark, whose tragic death at Ladysmith on Nov. 18th last had been recently reported. Dr. Stark, who had spent many years in different parts of South Africa, and had made its avifauna his special study, had, it was believed, nearly completed a second volume containing the remaining families of the Passeres, the MS. of which Mr. Sclater had good reason to hope would be recovered.

Mr. Sclater had himself completed an account of the Mammals, which was already in the printers' hands. Other volumes on the Reptiles, Batrachians, Fishes, and some of the groups of Invertebrates would follow.

The area embraced in the 'Fauna of South Africa' would be that portion of the continent which lay south of the Zambesi and Cunéné Rivers, and would contain the English Colonies of the Cape and Natal, Southern Rhodesia, the two Dutch Republics, and the adjoining German and Portuguese territories.

Passing on specially to the Mammals of this area, Mr. Sclater pointed out that, so far as his present information went, about 236 species had been hitherto recorded within these limits, but that there could be no doubt that, especially among the smaller forms, a great many more species remained to be added to the list by future investigators. Mr. Sclater concluded his remarks by speaking about some of the older travellers and collectors to whom we are mostly indebted for our earliest knowledge of South African zoology.

The following papers were read :—

1. On the Myology of the Edentata. By Bertram C. A. Windle, D.Sc., M.D., M.A., F.R.S., Professor of Anatomy in Mason University College, Birmingham, and F. G. Parsons, F.R.C.S., Lecturer on Human and Comparative Anatomy at St. Thomas's Hospital, late Hunterian Professor in the Royal College of Surgeons, England.

[Received November 9, 1899.]

Part II.—Muscles of the Hind Limb; and Summary of Conclusions respecting the Musculature of the Order.

The first part of this paper, dealing with the musculature of the trunk, head and neck, and anterior limb, was read before this Society on March 7th, 1899 (*cf.* Proc. Zool. Soc. 1899, p. 314). For convenience of reference we again append the list of animals on the dissection of which our generalizations are founded. The Arabic numerals before the name of each animal refer to the mention made of it in the text, whilst the Roman numerals following each name relate to the bibliography at the end of the paper. Where no such numeral is affixed it may be understood that we

are responsible for the dissection ourselves. We have to thank Mr. Burne, of the Royal College of Surgeons' Museum, London, for kindly permitting us to use the notes of his dissection of a specimen of *Chlamydophorus*.

List of Animals.

Family Bradypodidæ.

1. *Bradypus tridactylus.*
2. „ „ (Humphry, IV.)
3. „ „ (Macalister, XIV.)
4. „ „ (Meckel, XI.)
5. „ „ (Mackintosh, XVI.)
6. „ „ (Cuvier & Laurillard, XVII.)
7. „ „
8. *Cholœpus didactylus.*
9. „ „ (Humphry, IV.)
10. „ „ (Mackintosh, XIII.)

Family Myrmecophagidæ.

11. *Myrmecophaga jubata* [1].
12. „ „ (Couvreur & Bertaillon, II.)
13. „ „ (Macalister, I.)
14. *Tamandua tetradactyla.*
15. „ „ (Rapp, III.)
16. „ „ (Cuvier & Laurillard, XVII.)
17. *Cyclothurus didactylus.* (Humphry, IV.)
18. „ „ (Macalister, I.)
19. „ „ (Meckel, V.)
20. „ „ (Galton, VI.)
21. „ „ (Cuvier & Laurillard, XVII.)

Family Dasypodidæ.

22. *Dasypus villosus.*
23. „ *sexcinctus.* (Galton, X.)
24. „ „ (Cuvier & Laurillard, XVII.)
25. *Tatusia peba.* (Macalister, VII.)
26. „ sp. inc. (Meckel, XI.)
27. *Chlamydophorus truncatus.* (Macalister, VII.)
28. „ „ (Hyrtl, XII.)
28*a*. „ „ (Burne, MS. notes.)

Family Manidæ.

29. *Manis macrura.*
30. „ „
31. „ sp. inc.
32. „ *aurita.* (Humphry, IV.)
33. „ *tricuspis.* (Macalister, I.)
34. „ *javanica.* (Macalister, VII.)

[1] R.C.S. Eng. Collection.

Family Orycteropodidæ.

35. *Orycteropus capensis*. (Galton, VIII.)
36. „ „ (Humphry, IX.)
37. „ „ (Cuvier & Laurillard, XVII.)

Ectogluteus (*Gluteus maximus*) and *Caudo-femoralis* (*Agitator caudæ*).—In the *Bradypodidæ* the ectogluteus rises by fascia from the sacral and caudal spines; according to some authors from the crest of the ilium also. As its origin is fascial, there is clearly considerable scope for diversity of opinion and description on this point.

The insertion is into the shaft of the femur from just below the great trochanter to the middle or rather lower. No separate caudo-femoralis has been described in these animals, except in Cuvier & Laurillard's specimen (6), in which it was very small. It seems quite probable that, in the other specimens of which descriptions exist, it is fused with the ectogluteus. This hypothesis is supported to a certain extent by the fact that in our specimen of *Cholœpus* (8) the muscle had a double insertion, the anterior fibres passing to just below the great trochanter, thus obtaining the normal insertion of the ectogluteus in mammals, whilst the posterior fibres reached the middle and lower thirds of the femur. Among the *Myrmecophagidæ* the ectogluteus and caudo-femoralis can usually be separated from one another, the former passing to the upper part of the femur and to the fascia lata, the latter to the lower part of the bone. This was certainly the case in *Myrmecophaga* (11) and *Tamandua* (14, 16) and, to a less extent, in *Cyclothurus* (21), though most of the dissectors of this animal do not seem to have recognized the caudo-femoralis as a separate muscle. In the *Dasypodidæ* and *Manidæ* both the ectogluteus and caudo-femoralis are present, though usually closely united. In *Chlamydophorus* (28 *a*) the latter rose separately from the sphæroma end of the lower sphæroma support. In the *Orycteropodidæ* the ectogluteus is inserted into just below the middle of the femur, and the caudo-femoralis into the lower end (37).

Tensor fasciæ femoris and *ilio-tibialis* (*Sartorius*).—In the *Bradypodidæ* the ilio-tibialis is a well-marked muscle rising from the crest of the ilium and passing to the inner side of the head of the tibia. This applies to *Bradypus* (1, 4, 5, 6) and *Cholœpus* (8, 9). The muscular fibres rising external to this and in the same plane, instead of going to the fascia lata, accompany the ectogluteus to the outer surface of the shaft of the femur, but we are of opinion that they represent the tensor fasciæ femoris.

In the *Myrmecophagidæ* the ilio-tibialis is distinct and has the human attachments in *Myrmecophaga* (11) and *Cyclothurus* (17, 21). In *Tamandua* (14) and *Cyclothurus* (20) it rises from the tendon of the psoas magnus or parvus. The tensor fasciæ femoris is inseparable from the ectogluteus. In the *Dasypodidæ* both muscles are present, but whereas the ilio-tibialis is a delicate muscle in *Dasypus* (22, 23, 24), it is thick and fleshy in *Chlamydophorus*

(27, 28). In the *Manidæ* (29, 32, 33) the ilio-tibialis, tensor fasciæ femoris, and ectogluteus form a continuous sheet as in the majority of mammals, but the ilio-tibialis is remarkable for the frequency with which it is wholly or partly inserted into the inner side of the patella. In the *Orycteropodidæ*, Galton (35) describes the ilio-tibialis as arising from the ilio-pectineal tubercle, and Humphry (36) as coming from the last rib just external to the psoas.

Mesogluteus, Entogluteus, and Pyriformis.—The Edentata are remarkable for the imperfect differentiation of the meso- and entogluteus and the pyriformis, which three muscles form a large fleshy mass. Such being the case, it is not surprising that the literature of the subject presents us with very varying accounts of their condition. The fleshy mass above mentioned has the usual origin from the outer surface of the ilium and from the fascia which also gives origin to the ectogluteus. In *Bradypus* (1) and *Dasypus* (22) we separated a small entogluteus with some difficulty; it was inserted as usual into the front of the great trochanter. In *Orycteropus* (35, 37) the entogluteus was present, but Humphry says that in his specimen (36) it was scarcely distinguishable from the mesogluteus. The pyriformis is generally discernible in *Bradypus* (1, 4, 5, 6) and *Cholœpus* (8, 10), rising, as usual, from the inside of the pelvis. In *Tamandua* (14), *Dasypus* (22, 24), *Chlamydophorus* (28 *a*), and *Orycteropus* (35, 36, 37) it was also clearly made out. In all the other forms of which we have records it is described as absent or inseparable from the mesogluteus.

Gluteus profundus and *ventralis.*—A gluteus ventralis (g. quartus) was found in *Tamandua* coming from the whole ventral border of the ilium. This is probably the third gluteal described by Rapp (15). It is also mentioned in *Tatusia* (25) and *Cholœpus* (10), but it does not seem to be clearly differentiated with any frequency in the order. The gluteus profundus (g. quintus) has, so far as we have been able to ascertain, never been seen in Edentates.

Obturator internus and Gemelli.—Cuvier states in his 'Leçons,' "that, in animals which have the ischium ankylosed to the sacrum, a muscle coming from the external face of the ischium takes the place of the obturator internus and gemelli." This, in our opinion, is equivalent to saying that the intrapelvic portion of the obturator internus is absent. We found this arrangement existing throughout the Edentata, with the exception of the *Orycteropodidæ*, in which the typical mammalian arrangement occurs, both gemelli and the obturator internus being recorded as present (35, 36). In one case, however, Galton (35) states that the anterior gemellus was double, one being attached as usual, the other coming from the posterior half of the sacral edge of the great sacro-sciatic foramen; it seems possible that this so-called second gemellus may really have been a pyriformis.

Obturator externus.—In the *Bradypodidæ* this muscle was present and possessed the usual attachments in *Bradypus* (1, 2, 4) and *Cholœpus* (8); but in a second specimen of the latter (10) it is described as double, the upper part coming from the horizontal

ramus of the pubes near the acetabulum, the lower from the obturator membrane and horizontal ramus of the pubes. In the *Myrmecophagidæ* the muscle is present in *Tamandua* (14, 15) and *Cyclothurus* (17, 20). In the *Dasypodidæ* it is present in *Dasypus* (22, 23) and *Tatusia* (25), and was found in *Chlamydophorus* (28*a*), though not in the other two specimens (27, 28). In the *Manidæ* it tends to fuse with the quadratus femoris (29, 32, 33), but in one case (34) it was quite distinct. In the *Orycteropodidæ* (35, 36) it is present and normal.

Quadratus femoris.—This muscle is present with the usual attachments in *Bradypus* (1, 4, 5, 6), though Humphry failed to find it in his specimen (2). It is also present in *Cholœpus* (8, 10). In *Tamandua* (14) among the *Myrmecophagidæ* it is present, but in *Cyclothurus* (17, 20) it is described as wanting. In the *Dasypodidæ* it is a strong, distinct, rounded mass in *Dasypus* (22, 23, 24), which rises from the ischial ramus under cover of the adductor mass, and is inserted into the posterior aspect of the lesser trochanter. In *Tatusia* (25) it was absent, while in *Chlamydophorus* (27, 28) it was present and triangular in shape. In the *Manidæ* the frequency with which it becomes fused with the obturator externus has already been noticed. In the *Orycteropodidæ* it was absent in both Humphry's and Galton's specimens (35, 36).

Pectineus.—In the *Bradypodidæ*, *Bradypus* is remarkable for the extensive insertion which this muscle possesses, as it is attached to the whole length of the shaft of the femur (1, 3). In one specimen (4) it consists of superficial and deep layers, and in that figured by Cuvier & Laurillard (6) it is divided longitudinally. In *Cholœpus* (8, 9, 10) it rises from the pectineal tubercle, and is inserted into the upper half or somewhat less of the femur. In the *Myrmecophagidæ*, the muscle is single in *Myrmecophaga* (11, 12) and *Cyclothurus* (17, 19, 21). In the former animal it arose from the brim of the pelvis opposite the ilio-pectineal eminence, and was inserted into the upper two-thirds of the shaft of the femur. It was entirely supplied by the anterior crural nerve. In *Tamandua* (14) it was double, and the part which rose superficially was inserted by a small tendon just above the middle of the femur. The deeper portion was inserted above the last and in the same line with it, reaching as high as the lesser trochanter. In another specimen (15) Rapp describes the muscle as very thick. In the *Dasypodidæ* the muscle seems usually to be single and small. In the *Manidæ* it is also small but distinct, and is inserted just below the lesser trochanter. In one specimen of *Orycteropus* (35) Galton found the pectineus double; one portion was strap-shaped and passed from the ilio-pectineal eminence to the linea aspera, the other part from the same origin extended to the posterior intertrochanteric line. In Cuvier and Laurillard's specimen it was also double (37), whilst in the animal dissected by Humphry it was single (36).

Adductor femoris mass.—In *Bradypus* (1) the adductor longus was distinct and, rising from the ilio-pectineal line, extended to the

femur just above the internal condyle. The rest of the mass came from the sub-pubic arch and was inserted into the middle third of the femur. The other two specimens of which we have records (2, 5) were dissected at a time when the presemimembranosus was as yet unrecognized as a separate muscle, and we suspect that the description of this muscle is included in that of the adductors. It is worth noting that the pectineus and adductors rise as near the middle line of the body as they can, and wrap well round the back of the femur so as to act powerfully as external rotators. In *Cholœpus* (8), when the presemimembranosus is kept separate, the adductors closely agree with those of *Bradypus*. Among the *Myrmecophagidæ*, *Myrmecophaga* has the mass divided into two planes, the more superficial of which rises from the horizontal ramus and anterior half of the symphysis of the pubes and is inserted into the lower half of the femur. This part is pierced by the branch of the obturator nerve to the posterior adductor cruris (gracilis), and possibly, therefore, corresponds to the human adductores longus et brevis. The more posterior part of the mass has the same origin as the last, but lies deep to it and obtains origin from rather more of the symphysis; it is inserted into the lower two-thirds of the femur, and probably corresponds to the human adductor magnus. The whole of the adductor mass is supplied by the obturator nerve. In *Tamandua* (14) two layers can also be made out, both inserted below the middle of the femur. Rapp (15) says of this animal that the adductors cannot be divided into three layers. In *Cyclothurus*, Humphry (17), Meckel (19), and Galton (20) were all able to distinguish three layers, but possibly one of these was the presemimembranosus. The *Dasypodidæ* (*Dasypus* 22, 23, *Tatusia* 25, and *Chlamydophorus* 27, 28, 28*a*), all present an indivisible adductor mass. In the *Manidæ* we were able to make out three distinct parts, viz., (*a*) to the outer border of the femur above the condyles under cover of the outer head of the gastrocnemius (which reaches unusually high up), this is probably adductor longus; (*b*) to the middle third of the femur (adductor brevis); and (*c*) the most posterior (adductor magnus) to the lower part of the femur. In other specimens (32, 33, 34) the dissectors all agree that three layers can be seen. In the *Orycteropodidæ* (35, 36) three layers are also described.

Adductor cruris (*Gracilis*).—The *Bradypodidæ* seem remarkable for the constant presence of a double adductor cruris, but the insertion differs from that which one is accustomed to associate with the double condition of that muscle amongst the Mammalia. In our specimen of *Bradypus* (1) the anterior adductor cruris rose from the inner part of Poupart's ligament, and was inserted into the upper part of the inner surface of the tibia. The posterior rose from the symphysis pubis, and, after reaching the knee, passed in front of the shaft of the tibia to be inserted into the fascia on the outer side of the leg below, and continuous with the insertion of the flexor cruris lateralis (biceps). Both parts were supplied by the obturator nerve. In Cuvier and Laurillard's

specimen (6), the posterior muscle, instead of passing round the front of the leg as it did in our case, wrapped round the back of the thigh, and was inserted just below the insertion of the flexor cruris lateralis. Humphry (2) also found the muscle double, but Mackintosh does not seem to have noticed this condition in his specimen. In *Cholœpus* we have records of three specimens (8, 9, 10), all of which agree in calling the muscle double. Among the *Myrmecophagidæ*, *Myrmecophaga* (11) has a double muscle, the anterior part of which rises from the ramus of the pubes internal to the ilio-pectineal eminence, and is inserted into the upper two-thirds of the cnemial crest of the tibia. The posterior part rises from the symphysis and descending ramus of the pubes, and is inserted below the last, into the lower part of the cnemial crest and shaft of the tibia as low as the middle of the bone. In *Tamandua* (14) the muscle rises from the sub-pubic arch, and in section would appear V-shaped, with the apex of the V directed mesially and its concavity including the adductor mass. Though there is no actual line of fission along it, yet the apex of this V clearly is equivalent to the line of separation into anterior and posterior portions in *Myrmecophaga*. The wide and strong insertion of this muscle is into more than half of the inner side of the tibia. Rapp describes this muscle as very broad in his specimen (15). In *Cyclothurus* (17, 19, 20) the muscle is single and broad. Among the *Dasypodidæ* the adductor cruris may be either single or double, the latter condition obtaining as far as its insertion into the fascia of the leg from the knee to the ankle in our specimen (22). In another specimen (24) it was single. Galton (X.) describes it as a thin muscle in *Dasypus* (23), but Macalister (VII.) says that it is broad in *Tatusia* (25). In *Chlamydophorus* (27, 28 *a*) it is single and thin. In the *Manidæ* the muscle may also be single or double. In two cases (32, 34) it fell under the former category, and in other two (29, 33) under the latter. In all cases the muscle is of specially large size in this family. In the *Orycteropodidæ* (35, 36, 37) the adductor cruris is single and broad.

Semimembranosus.—In all the Edentates the semimembranosus is a very constant muscle rising from the tuber ischii and part of the ramus, and obtaining insertion into the upper part of the internal surface of the tibia, deep to the long internal lateral ligament. The tibial insertion is especially extensive in the *Dasypodidæ*, and it is remarkable that in these animals the long internal lateral ligament is attached nearly as low as the middle of the tibia.

Presemimembranosus.—By many observers this has not as yet been recognized as a separate muscle, some including it in the adductor mass, others describing it with the semimembranosus. Haughton calls it the adductor primus; Macalister, the adductor magnus condyloidea. In our specimens of *Bradypus* (1) and *Cholœpus* (8) it was a perfectly distinct muscle, rising from the tuber ischii, and being inserted into the femur just above the

internal condyle and the inner head of the gastrocnemius. *Myrmecophaga* (11, 12) and *Tamandua* (14, 16), amongst the *Myrmecophagidæ*, have also perfectly distinct representatives of this muscle; and in *Cyclothurus* (17, 19, 20) it is also evidently present. Galton (20) speaks of it as a second head of the semitendinosus. In the *Dasypodidæ*, *Manidæ*, and *Orycteropodidæ* the muscle is also evidently present, but seems to be rather more closely united with the semimembranosus.

Semitendinosus.—The chief point of interest about this muscle is the varying presence of ischial, caudal, or both heads. In the *Bradypodidæ*, *Bradypus* (1, 2, 4, 5, 6) and *Cholœpus* (8, 9, 10) possess only the origin from the tuberosity of the ischium, the insertion being as usual into the upper part of the internal surface of the tibia. In the *Myrmecophagidæ*, our specimen of *Myrmecophaga* (11) was especially interesting in that in it the caudal and ischial origins remained separate right down to their insertions, and so formed two distinct muscles. The first of these (semitendinosus anterior) rose from the tuber ischii, and was inserted into the internal tuberosity of the tibia just below the insertion of the semimembranosus. The second (semitendinosus posterior) rose from the anterior caudal vertebræ, continuing the origin of the caudo-femoralis, and was inserted into the tibia just below the last. Both these muscles were supplied by the great sciatic nerve. In *Tamandua* (14, 15) only the caudal head was present. In *Cyclothurus* (17, 20, 21) the caudal head was alone present, but in another specimen (19) the ischial head was the only one found. Among the *Dasypodidæ*, *Dasypus* (22, 23) and *Chlamydophorus* (27, 28 *a*) had only the ischial head, but in *Tatusia* (25) both ischial and caudal heads were present. A strong prolongation, extending to the heel, from the insertion of the muscle was noticed in *Dasypus* (22). In the *Manidæ* (29, 32, 33, 34) the caudal head is always present, and in two instances (33, 34) an ischial head was also found, though it was small in the first-mentioned specimen. In the *Orycteropodidæ* (35, 36, 37) the ischial head alone was found, and the same prolongation to the heel already alluded to in *Dasypus* was noticed. It will thus be seen that the ischial head is alone present in the *Bradypodidæ* and *Orycteropodidæ*; it is also always present in the *Dasypodidæ*, though occasionally accompanied by a caudal head. In the *Manidæ* the caudal head is always found, and the ischial, if present, is subsidiary; while in the *Myrmecophagidæ* either ischial or caudal, or both heads may appear. The presence of a tendinous intersection in the muscular belly of the semitendinosus has evidently been sought for by many of the dissectors of these animals, but so far we have only found its presence recorded in one specimen of *Chlamydophorus* (27) described by Macalister.

Flexor cruris lateralis (*Biceps femoris*).—Among the *Bradypodidæ*, *Bradypus* (1, 2, 4, 5) and *Cholœpus* (8, 9, 10) have the muscle rising from the tuberosity of the ischium, but not from the caudal vertebræ. The insertion is usually into the fascia of the

leg, by which its fibres may be traced to the fibula and tibia in their upper ends. In addition to this long and constant mammalian part of the muscle, a femoral origin was found in all the specimens of which we have records. This femoral or short head always seems to have a very extensive origin from the shaft of the femur, and in our specimen of *Cholœpus* it was one of the largest muscles in the hind limb. Its insertion is usually lower than that of the long head, and may be connected with the tendo Achillis; moreover it is not always fused even at its insertion with the long head. Among the *Myrmecophagidæ* the long head, in our specimen of *Myrmecophaga* (11), rose from the ischium and was inserted into the fascia over the upper part of the fibula. The short head was not so large as in the *Bradypodidæ*, and instead of rising from the shaft of the femur, it took origin from the insertion of the caudo-femoralis, it then crossed deeply to the long head, forming an X with it, to be inserted into the gastrocnemius at the point where the tendo Achillis commenced to exist[1]. In our specimen of *Tamandua* (14) there was no femoral head, neither do Rapp nor Cuvier and Laurillard mention one in theirs (15, 16), though Macalister states that it is to be found in this animal. In *Cyclothurus* (17, 18, 19, 20, 21) all the authorities are agreed as to the presence of the femoral head; and Meckel (19) says that it is inserted into the outer malleolus, an assertion with which Cuvier and Laurillard agree. In the *Dasypodidæ* we find no indication of a femoral head in *Dasypus* (22, 23, 24), *Tatusia* (25), or *Chlamydophorus* (27, 28, 28 *a*). In the *Manidæ* a femoral head was found (29, 32, 33), while in the *Orycteropodidæ* no femoral head is recorded by any of the observers from whom we quote.

Tenuissimus (*Bicipiti accessorius*).—For reasons which will appear later, we wish to contrast the presence or absence of this muscle with the condition of the long head of the last described muscle. First, however, we call attention to the fact that in most mammals the tenuissimus arises from the anterior sacral vertebræ under cover of the ecto-gluteus or caudo-femoralis and passes down, as a narrow ribbon-like muscle, to be inserted with the lowest fibres of the flexor cruris lateralis, *i. e.*, with those fibres which most nearly attain the ankle. As these fibres are often inserted into the tendo Achillis or gastrocnemius, it is clear that this will not be an uncommon insertion for the tenuissimus. In the *Bradypodidæ* we noticed that the femoral head of the flexor cruris lateralis is always present. In no specimen of *Bradypus* (1, 2, 4) or *Cholœpus* (8, 9, 10) is the presence of a tenuissimus mentioned, while in our specimens (1, 8) we specially looked for it and can definitely state that it was absent. Amongst the *Myrmecophagidæ*, *Myrmecophaga* (11, 12) has a short head for the flexor cruris lateralis, which, instead of rising from the femur, comes from the surface of the caudo-femoralis. This animal has no tenuissimus. Our *Tamandua* (14) had a typical mammalian

[1] MM. Couvreur and Bertaillon describe an identical arrangement in their specimen (12).

tenuissimus, but no short head of flexor cruris lateralis, and the same condition existed in Cuvier and Laurillard's specimen (16). All the specimens of *Cyclothurus* had femoral heads for flexor cruris lateralis, but in none of them is a tenuissimus recorded. In the *Dasypodidæ* a short head of flexor cruris lateralis is never found, but in *Dasypus* (22, 23) and *Tatusia* (25) the tenuissimus was present, though not in *Chlamydophorus* (27, 28, 28 *a*). The *Manidæ* have a femoral head to the flexor cruris lateralis. In two cases (29, 33) there was no tenuissimus, in the others its presence is not mentioned. The *Orycteropodidæ* have no femoral head to the flexor cruris lateralis, but Galton (35) evidently found a tenuissimus in his specimen, though he calls it the second part of the semimembranosus. The fact that these two muscles, the short or femoral head of the flexor cruris lateralis and the tenuissimus, never in our records and dissections have been found to co-exist, made us suspect that the two muscles might be identical. This suspicion was strengthened when we noticed how similar the insertion of the two muscles was, the origin alone differing. The condition met with in our specimen of *Myrmecophaga* (11), as well as in that of MM. Couvreur and Bertaillon (12), makes us think that the caudo-femoralis acts as a "muscle-slide," down which the origin of the tenuissimus slips until it reaches the shaft of the femur, when it becomes a short head of the flexor cruris lateralis. Does this explain the morphology of the femoral head of the human biceps femoris? We are not prepared to commit ourselves to a definite statement of opinion until we have examined into the matter more fully, as we propose to do at a subsequent time, but so far as the evidence before us goes we are inclined to answer the question in the affirmative.

Quadriceps extensor cruris.—In all our dissections of Edentates we found the rectus rising by one broad head from the dorsal and cephalic margins of the acetabulum, and fusing more or less with the capsule of the hip-joint. Most of the other writers who give any details of the origin of this muscle speak of it as single-headed. Humphry, however, states that in *Orycteropus* (36) its origin is as in Man; though Galton, in his description of the same animal (35), says that the rectus rises from the superior and posterior margins of the acetabulum, not mentioning the fact that there are two distinct heads. Our experience of myology makes us think that in the Edentata, as in most mammals, there is one broad head, and that in Man this head becomes differentiated into two as an adaptation to the erect position. In other words, we believe that in the Edentates both the acetabular and iliac heads of the rectus are present, but that they are fused or not yet differentiated. Of the deeper parts of the quadriceps there is little to say beyond the fact that the quadricipitis lateralis (vastus externus) is always very large in proportion to the mesialis (vastus internus). In *Chlamydophorus* (27) Macalister found an extra head to the lateralis rising from the ilium beneath the origin of the superficialis (rectus femoris). This was not seen in the other two

specimens (28, 28 *a*). It is always difficult to separate the mesialis from the profundus (crureus).

Tibialis anticus.—Among the *Bradypodidæ* it is rather difficult to determine the line of demarcation between this muscle and the extensor hallucis, more especially as in both kinds of Sloths the hallux is aborted. In four specimens of *Bradypus* (1, 4, 5, 6) the muscle rose from the anterior surfaces of the tibia and fibula, and was inserted into the rudimentary first metatarsal bone. In *Cholœpus* (8, 9, 10) the origin was the same, but the tendon, instead of being inserted into the metatarsal, winds round the ankle to the plantar surface of the foot, and is inserted into the long flexor tendons. In Humphry's specimen (9) and in our own (8) it divided into three slips which joined other three slips from the flexor longus digitorum (tibialis? fibularis?), while in Mackintosh's animal (10) it only joined the flexor of the middle toe. Among the *Myrmecophagidæ*, the muscle is single in *Myrmecophaga* (11) and rises from the upper $\frac{2}{3}$ of the tibia to be inserted into the entocuneiform and slightly into the base of the first metatarsal. In *Tamandua* (14) there were tibial and fibular origins, and the insertion was into a sesamoid bone on the inner side of the navicular. In *Cyclothurus* (17, 19, 20, 21) there were tibial and fibular origins, and the insertion in all cases was into the entocuneiform. Among the *Dasypodidæ*, *Dasypus* (22, 23) has tibial and fibular origins, and an insertion into the entocuneiform, but in *Tatusia* (25) and *Chlamydophorus* (27) only the tibial origin was found. In this family the muscle is particularly large. In the *Manidæ* (29, 32, 33) there are tibial and fibular origins, and the insertion is into the entocuneiform and first metatarsal. In the *Orycteropodidæ* (35, 36, 37) it rises from the upper half of the tibia and from the fibula. In Humphry's and Galton's specimens (35, 36) its tendon divides, and is inserted into the first metatarsal and entocuneiform.

Extensor proprius hallucis.—In the *Bradypodidæ* we found no separate representative of this muscle in our specimen (1). Humphry (2) and Meckel (4), however, found a small muscle rising from the lower end of the fibula and passing to the rudimentary first metatarsal, a condition also figured by Cuvier and Laurillard (6). In *Cholœpus* (8, 9, 10) a similar condition was observed. Among the *Myrmecophagidæ*, *Myrmecophaga* (11) and *Tamandua* (14, 15) have the muscle rising from the lower end of the fibula and inserted into (11, 12, 14) the terminal phalanx of the hallux, but in Rapp's specimen (15) it also went to the second toe. In *Cyclothurus* the extensor proprius hallucis is noticed by both Humphry and Galton; but the long extensor muscles of the foot were evidently imperfectly differentiated, for Humphry (IV.) found the muscle joining the tendon of the tibialis anticus, whilst in Galton's specimen (20) it united with that of the extensor longus digitorum. In the *Dasypodidæ*, *Dasypus* (22, 23), *Tatusia* (25), and *Chlamydophorus* (27, 28 *a*), the muscle always rises from the lower part of the fibula and is

inserted into the hallux. In the *Manidæ* (29, 32) the same description applies, but in one case (32) a small slip was given to the second toe as well as to the first. In the *Orycteropodidæ* (35, 36) the muscle rises rather higher up from the fibula, and in both cases had a slip of communication with the extensor longus digitorum.

Extensor longus digitorum.—In the *Bradypodidæ*, *Bradypus* (1, 2, 4) and *Cholœpus* (8, 9) have the usual origin from just above the external condyle of the femur; but in Meckel's specimen of *Bradypus* (4) tibial and fibular origins were also met with. In *Bradypus* the insertion is never into the toes. In our specimen (1) the tendon divided into two slips, which were inserted into the bases of the innermost and outermost of the three developed metatarsal bones; it will be observed that the outermost of these is the same muscle as the human peroneus tertius. Cuvier and Laurillard's figure agrees very closely with our specimen, though they call this part of the muscle the peroneus brevis (6). In Humphry's specimen (2) the whole muscle was apparently inserted into the outermost metatarsal, while in Meckel's (4) it went to the innermost. In *Cholœpus* the insertion may be into the dorsum of all three toes (8, 10), or only into the second and third (9). Among the *Myrmecophagidæ*, the origin is condylar in *Myrmecophaga* (11) and *Tamandua* (14), but in *Cyclothurus* it rises from the tibia only (17, 19), or the tibia and the fibula (20). The insertion is usually into the four outer toes, though in Cuvier and Laurillard's figure (21) it appears as if slips only went to the third and fourth toes, and in Couvreur and Bertaillon's specimen of *Myrmecophaga* into the three outer toes. In the *Dasypodidæ* a femoral origin is never found, the muscle rising from the upper part of the fibula only, and being inserted into the four outer toes. This description applies to *Dasypus* (23), *Tatusia* (25), and *Chlamydophorus* (27, 28*a*). In one specimen of *Dasypus*, however, (22) a slip was sent to the hallux as well as the other four toes; otherwise this specimen agreed with the rest. In the *Manidæ* the chief origin is from the tibia and fibula (29, 32, 33, 34), but in some specimens (32, 34) a feeble femoral origin is found. The insertion is into the outer three (29, 33) or four (32) toes. In the *Orycteropodidæ* (35, 36) there is the normal femoral origin, and the insertion into the four outer toes (35, 36, 37). We have already drawn attention to the connection with the extensor proprius hallucis.

Extensor brevis digitorum.—In the *Bradypodidæ* this muscle usually rises from the lower end of the fibula (1, 4, 6), but sometimes from the tarsal bones (presumably calcaneum) (2). It generally sends slips to all three toes (1, 2), but in one case (4) it only sent a tendon to the inner toe. In *Cholœpus* (8, 9, 10) the muscle always rises from the tarsus and is inserted into the long tendons of all the toes. In the *Myrmecophagidæ* the muscle always rises from the tarsus. In *Myrmecophaga* (11) and *Tamandua* (14, 15) it sends slips to all five toes, but in *Cyclothurus* (17, 19, 20, 21) only to the four

outer. In the *Dasypodidæ* the origin is always tarsal (calcaneal with occasional additional slips). In *Dasypus* (22, 24) the insertion was into the second, third, and fourth digits, though in another specimen (23) into the first, second, and third. In *Tatusia* (25) its insertion was into the second, third, and fourth toes, while in *Chlamydophorus* it was inserted into the four outer toes. In the *Manidæ* the fibular origin sometimes occurs as in *Bradypus*, at least this was the case in our specimen (29), though in Humphry's (32) it came from the tarsus. The insertion may be into the four outer toes (32, and apparently 34), or into all of them (29). In the *Orycteropodidæ* (35, 36) the muscle rises from the calcaneum, and is inserted in one (37) into the three inner toes, in another (36) into the three middle toes.

Peroneus longus.—In the *Bradypodidæ* this muscle was found in three specimens of *Bradypus* (2, 4, 5) rising from the condyle of the femur and upper part of the fibula, its insertion in all cases being into the base of the outermost metatarsal bone. In our specimen of *Bradypus* (1) we failed to find any peroneus longus at all, and it is absent in Cuvier and Laurillard's plate (6). In *Cholœpus* (8, 9, 10) the muscle only rises from the upper part of the fibula and is inserted into the base of the outermost metatarsal bone; so that in the family of the *Bradypodidæ* we think we are able definitely to state that the peroneus longus tendon never runs across the sole of the foot. Among the *Myrmecophagidæ*, the muscle rises from the tibia and fibula in *Myrmecophaga* (11), from the fibula and semilunar cartilage in *Tamadua* (14), and from the fibula only in *Cyclothurus* (17). In no member of this family has a femoral head been found. The tendon always runs across the sole and is inserted into the innermost metatarsal bone or bones, into the entocuneiform, or (20) into the navicular. Among the *Dasypodidæ* the muscle has patellar and fibular origins in *Dasypus* (22)[1] and *Tatusia* (25), but only fibular in *Chlamydophorus* (27, 28). In another specimen (28 *a*) of this animal there was an additional origin from the patella. In all these animals the tendon passes across the sole of the foot. In the *Manidæ* (29, 32, 33) the muscle rises from the fibula and passes across the sole of the foot. In the *Orycteropodidæ* there is no definite femoral origin, but the peroneus longus rises from the external lateral ligament and semilunar cartilage as well as from the upper part of the fibula. The tendon passes across the sole to the first metatarsal bone. In those animals, such as the *Bradypodidæ* and *Dasypodidæ*, which have a femoral origin for the peroneus longus, there is a distinct external lateral ligament in addition. This fact is of considerable importance in arriving at a conclusion with regard to the morphology of that ligament.

Peroneus brevis.—In the *Bradypodidæ* this muscle was present in three specimens (2, 4, 5), but was absent in the fourth (1). It rose from the lower part of the fibula and was inserted into the

[1] This was also seen in another dissection at the Royal College of Surgeons.

base of the outermost metatarsal. In *Cholœpus*, Humphry (9) found the muscle as in *Bradypus*, but in another specimen (10) as well as in our own (8) it was not seen. In the *Myrmecophagidæ* the muscle is present in *Myrmecophaga* (11, 12), *Tamandua* (14, 15), and *Cyclothurus* (19). In *Dasypus* (22 and another) among the *Dasypodidæ* the muscle rose from the outer side of the fibula and from the external condyle. It is also present in *Chlamydophorus* (27, 28, 28 *a*). In the *Manidæ* (29, 32, 33) and *Orycteropodidæ* (35, 36) the muscle is present and normal.

Peronei tertius, quarti et quinti digiti.—It is difficult, in reviewing the literature, to feel perfectly certain as to the identity of these muscles. Macalister (VII.) says "there is no trace whatever of a true peroneus tertius in any of the species examined, *Chlamydophorus*, *Tatusia*, *Dasypus*, *Bradypus*, *Cholœpus*, *Orycteropus*, *Pholidotus*, *Cyclothurus*, or *Tamandua*. The muscles described as such by authors are, in reality, peronei quinti." We have little doubt that Macalister is right in many cases, but we have some doubt as to whether the statement applies accurately to all, since we have seen and already described a typical peroneus tertius in *Bradypus*. The points which, in our opinion, enable a right decision to be arrived at in the case of a doubtful peroneus tertius or p. quinti digiti are (*a*) its nerve-supply; (*b*) its relation to the ankle, whether anterior or posterior; (*c*) its insertion into the extensor tendon or into the metatarsal bone of a digit. Unfortunately many writers fail to give details on some of these points or on all of them, and for this reason any generalizations which we may venture to offer must be taken with a reservation. In the *Bradypodidæ* a well-marked peroneus tertius, inserted into the base of the metatarsal bone, passing in front of the ankle, and supplied by the anterior crural nerve, was found. Meckel (XI.) and Mackintosh (XVI.) mention a peroneus quinti, which the latter says is inserted into the tuberosity of the outer metatarsal. In *Cholœpus* (9, 10) a peroneus tertius is described, Humphry (9) stating that it came from the *front* of the fibula and was inserted into the bases of the two outer metatarsal bones. The relation to the ankle is not mentioned, but from what we learn as to its origin and insertion we are inclined to agree as to the correctness of this denomination. It should be borne in mind that both *Cholœpus* and *Bradypus* have only three toes on the hind foot; so that a peroneus quinti is not, so far as we have learnt the lessons of mammalian myology, a muscle with which one would expect to meet. In the *Myrmecophagidæ* the outer or fifth toe is always developed, and we find that both *Myrmecophaga* (11) and *Tamandua* (14) have a peroneus quinti digiti, but we have not been able to satisfy ourselves as to the absence or presence of this muscle in *Cyclothurus*. In the *Dasypodidæ* the peroneus quinti is present in *Dasypus* (22 and another) and *Chlamydophorus* (27, 28 *a*). In the *Manidæ* (29, 32, 33) we find no account of a peroneus quarti or quinti. In the *Orycteropodidæ* (35, 36) all four peronei were present, viz., longus, brevis, quarti et quinti digitorum.

Gastrocnemius.—This muscle, amongst the Edentata, has, with certain exceptions, the typical mammalian arrangement. In the *Bradypodidæ* the two heads do not unite until they reach the calcaneum, but they are not twisted in such a way that the inner becomes superficial and then external (*cf.* Journal of Anat. & Phys. vol. xxviii. p. 414). This is true of *Bradypus* (1, 2) and *Cholœpus* (8, 9, 10). In the *Manidæ* (29, 32, 33) the external head is very large and rises a long way up the shaft of the femur—a condition far exceeding anything which we have hitherto observed in any other mammal. It is interesting to notice that nearly all observers have recorded the absence of fabellæ except in the *Orycteropodidæ*.

Soleus.—Among the *Bradypodidæ* the soleus often rises quite low down on the fibula in *Bradypus*, in which animal it arose in one case (5) from the middle, and in another (1) from the lower third of the bone. It is inserted into the calcaneum without joining the tendo Achillis (1, 2). In *Cholœpus* the chief insertion is also into the calcaneum in front of the tendo Achillis, but Humphry noticed that some of its fibres were continuous with those of the accessorius. Among the *Myrmecophagidæ* its origin was chiefly from the fascia over the deep flexor muscles in *Myrmecophaga* (11)[1]. In the last-mentioned animal, in *Tamandua* (14), and in *Cyclothurus* (19, 20) it is inserted as in the *Bradypodidæ*. In the *Dasypodidæ* it seems usually to join the outer head of the gastrocnemius, but our information is not very clear upon this point. In the *Manidæ* (29, 32) and *Orycteropodidæ* (35, 36) its insertion is as in the *Bradypodidæ* and *Myrmecophagidæ*. It will thus be seen that the Edentata as an order are characterized by the separate insertion of the soleus and the absence or incompleteness of the tendo Achillis.

Plantaris.—This muscle is liable to a good deal of variation in the Edentata, and is likely to be confused, on the one hand, with the femoral head of the flexor cruris lateralis (biceps), and, on the other, with the flexor tibialis and fibularis. In the *Bradypodidæ* the muscle was absent in one specimen (1), but in three others (2, 4, 5) it was present as a very large muscle which rose from above the external condyle of the femur, and was inserted into the long flexor tendons in the sole of the foot. It is described by some writers as an extra head of the long flexors of the toes. In *Cholœpus* (8, 9, 10) the muscle is absent, but the condition in this form will be again referred to under the head of the tibialis posticus. Among the *Myrmecophagidæ* it is present in *Myrmecophaga* (11) and has the usual mammalian insertion into the plantar fascia. In *Cyclothurus* (17, 19, 20) it is also present, and is inserted into the elongated ossicle on the tibial side of the foot. This insertion is interesting when compared with that which is found in the hand of *Pedetes* (*cf.* Proc. Zool. Soc. 1898, p. 867), in which the palmaris longus, the serial homologue of the plantaris, is inserted into the

[1] In (12) it had the generalized mammalian origin from the back of the head of the fibula.

radial ossicle, or so-called pre-pollex. In *Tamandua* (14, 15) the muscle is absent. Among the *Dasypodidæ* the plantaris rises from the ridge above the external condyle in *Dasypus* (22, 23), and is continued into the sole of the foot, where it flattens out and sends slips to three or four of the digits, which slips are perforated by the tendons of the flexor longus digitorum. In *Tatusia* (25) there is no separate plantaris. In *Chlamydophorus* (27, 28, 28 *a*) the tendon passes into the sole of the foot, where it divides into four slips. In the *Manidæ* (29, 32, 33, 34) there is no separate plantaris, it is probably fused with the very large external head of the gastrocnemius. In the *Orycteropodidæ* (35, 36, 37) the generalized mammalian arrangement is found; the plantaris passes under the tuberosity of the calcaneum, and forms a fibrous flexor brevis digitorum for the four outer digits.

Flexor brevis digitorum.—In the *Bradypodidæ* (1, 2, 5, 9, 10), *Myrmecophagidæ* (11, 14, 15, 17), and *Manidæ* (29, 32), the muscle rises from the posterior part of the lower surface of the calcaneum, and has no connection with the plantaris when that muscle is present. The insertion is into the three middle or four outer digits. The tendons are usually inserted into those of the flexor longus, instead of being perforated by the latter. The information, however, as to the manner of ending of these tendons is very scanty. In the *Dasypodidæ* (22, 23, 27, 28) and *Orycteropodidæ* (35, 36, 37) the flexor brevis is a continuation of the plantaris, as in most generalized mammals.

Flexores tibialis et fibularis.—In the *Bradypodidæ* these two muscles are difficult to distinguish: in any case they coalesce before reaching the ankle, and then divide into three tendons, which pass to the second, third, and fourth toes respectively. This applies to *Bradypus* (1, 2, 5) and *Choloepus* (8, 9, 10). In some records of *Bradypus* (2, 5) a femoral head is also recorded, but a consideration of the conditions has decided us to regard this as a plantaris. Among the *Myrmecophagidæ* the two muscles are practically inseparable; they form a single flat tendon, which in *Myrmecophaga* (12) and *Tamandua* (15) has a sesamoid body where it passes into the sole of the foot. In *Tamandua* (14, 15) tendons pass to all five toes, but in *Cyclothurus* (17, 19, 20) there is no slip for the hallux. In the *Dasypodidæ* (22, 23, 25) the tibial and fibular heads unite in the lower part of the leg and are inserted into a very large sesamoid bone in the sole of the foot, which is held in place by a fibrous band from the calcaneum, the equivalent of the accessorius. From the front of the sesamoid bone five tendons pass to the terminal phalanges of the five digits. In *Chlamydophorus* (27) the sesamoid bone was replaced by a cartilaginous nodule. In the *Manidæ* (22, 23, 25) the two muscles are much more distinct, the flexor fibularis forming a very large tendon into the inner side of which the small tendon of the flexor tibialis is inserted. There are tendons for the four outer toes, but none for the hallux. In the *Orycteropodidæ* (35, 36) the flexores tibialis et fibularis fuse in the leg and from the tendon

slips are given off to all five toes. The tendon is joined in the sole by a slip from the tibialis posticus accessorius.

Popliteus.—In the *Bradypodidæ* (1, 2, 4, 8, 9, 10), *Myrmecophagidæ* (12, 14, 17, 19, 20), and *Manidæ* (29, 32, 33, 34) this muscle is large, occupying the upper half of the tibia; its origin is from the outer condyle, and a sesamoid cartilage or bone is developed in its tendon. In the *Orycteropodidæ* (35, 36) its insertion is singularly extensive, but no sesamoid is mentioned as having been observed. In *Dasypus* (22, 23) two tendons of origin were noticed, the anterior and larger coming from the outer side of the condyle and the external semilunar cartilage, the posterior and smaller from the posterior part of the condyle. In *Tatusia* (25) and *Chlamydophorus* (27, 28, 28*a*) this double origin was not seen. In no member of the *Dasypodidæ* was a sesamoid cartilage observed. The Edentata are characterized, as an order, by the large size of their popliteus.

Tibialis posticus.—In the *Bradypodidæ* this muscle is single and small; it usually rises from the middle or lower part of the shaft of the tibia, and is inserted into the entocuneiform bone. In the other families (*Myrmecophagidæ*, *Dasypodidæ*, *Manidæ*, and *Orycteropodidæ*) the muscle is usually double, the more external being inserted into the navicular or sometimes the entocuneiform, whilst the other is often larger and passes to the tibial ossicle on the inner side of the foot. This additional tibialis posticus is called by Galton tibialis posticus secundus, and by Hyrtl tibialis posticus accessorius.

Accessorius.—In the *Bradypodidæ* this muscle is always well developed. Humphry states that in *Cholœpus* (9) and *Bradypus* (2) it was continuous with the tendon of the soleus. We have carefully dissected both these animals, but found no connection whatever between the two muscles, nor have other observers described it. In the *Myrmecophagidæ* (11, 14, 15, 17, 20) and *Manidæ* (29, 32, 33) it rises as usual from the lower surface of the calcaneum, and is inserted into the conjoined deep flexors in the sole. In *Myrmecophaga* (11) it is especially large. In (12) it gives off a special slip to the hallux tendon. In the *Dasypodidæ* (22, 23, 25, 27) there is no muscular accessorius, but its place is taken by the fibrous band which binds the great sesamoid bone of the sole of the foot to the under surface of the calcaneum. In the *Orycteropodidæ* (35, 36) the muscle is also replaced by tendinous bands from the calcaneum to the outer side of the long flexor tendons.

Lumbricales.—In the *Bradypodidæ* we found no lumbricales in our specimens of *Bradypus* (1) and *Cholœpus* (8), and their presence is not mentioned by other observers. In *Tamandua* (14) and *Cyclothurus* (17), among the *Myrmecophagidæ*, they were not seen, but Galton in another specimen of *Cyclothurus* found three. In *Myrmecophaga* (12) there were four. The *Dasypodidæ* (22, 25, 27) always have at least four lumbricales, and in one specimen of *Dasypus* (23) Galton describes seven. In the *Manidæ* (29, 32, 34)

three lumbricales are usually found, while in the *Orycteropodidæ* (35, 36) there are four.

Musculi breves pedis.—The abductores hallucis et minimi digiti are of course absent in the *Bradypodidæ*, but in all the other families they are present. In the *Orycteropodidæ*, however, the abductor hallucis is replaced by fibrous tissue. The flexor brevis hallucis is present in all Edentates except the *Bradypodidæ*. In the *Orycteropodidæ* (35, 36) its absence is noted, but Humphry (36) states that it is replaced by fibrous tissue. It is present in all other Edentata, including *Cyclothurus*. The abductor minimi digiti is present in the *Myrmecophagidæ*, *Dasypodidæ*, *Manidæ*, and *Orycteropodidæ*; it usually rises from the base of the fifth metatarsal bone, instead of from the calcaneum as in most mammals. The superficial layer of deep muscles, *i. e.* those which lie superficial to the deep branch of the external plantar nerve and are usually called adductors, are wanting in the *Bradypodidæ* and *Manidæ*. In the following animals adductores hallucis et minimi digiti were found:—*Cyclothurus* (20), *Dasypus* (22), *Tatusia* (25), and *Orycteropus* (35, 36). *Tamandua* (14) in addition had an adductor indicis. The interossei are usually present as paired flexores breves, but in the *Dasypodidæ* and *Manidæ* a differentiation into dorsal and plantar groups is noticed; their exact arrangement, however, differs in different specimens of the same animal.

Abdominal Muscles.

Serratus dorsalis (*S. posticus*).—The two portions of this muscle, thoracis and lumbalis, seem to be but little developed in the Edentata, and this statement particularly applies to the former of the two. Amongst the *Bradypodidæ* the muscle is represented only by a fibrous sheet in *Bradypus* (1), whilst in *Cholœpus* (10) the thoracic portion is absent, but the lumbar, attached to the lower ribs, is present. Amongst the *Myrmecophagidæ* a fibrous representative of the muscle was found in *Tamandua* (14); it is not figured, however, in Cuvier and Laurillard's plate of the same species (16). *Dasypus* amongst the *Dasypodidæ* does not seem usually to possess any representative of this muscle, for none was found in (22); Galton (23) does not mention one, nor is any figured by Cuvier and Laurillard (24). Indeed we could have asserted that there is none but for the fact that Macalister (VI.) seems to have found a representative of the muscle in one case. In *Tatusia* (25) a very feeble thoracis was found, and a lumbalis attached to the lower four ribs. *Chlamydophorus* (27, 28) had a similarly arranged lumbalis but no thoracis. In *Manis* (29) a fibrous representative was alone found. In *Orycteropus* (37) Cuvier and Laurillard figure a continuous sheet extending from the third to the tenth dorsal vertebra which appears to be an unusually well-developed thoracis.

Rectus ventralis.—This muscle in the majority of forms reaches as high a point of attachment as the first rib, though sometimes

it falls short of it. Amongst the *Bradypodidæ* this is particularly the case. In *Bradypus* (4, 5) it reached as high as the fifth rib, and in the latter had four tendinous inscriptions; in another (6) it was attached to the ribs from the fifth to the eighth, and in a fourth (7) from the third to the seventh. In this last two inscriptions were noted. Amongst the *Myrmecophagidæ*, *Tamandua* (14) has the attachment extending up to the first rib, and three indistinct intersections were seen. In *Cyclothurus* (19) the attachment was to the eight upper ribs with three tendinous intersections, whilst in another case (20) only the second to the sixth ribs gave origin to the muscle. Amongst the *Dasypodidæ* the first rib was the point of attachment in *Dasypus* (22), *Tatusia* (26), and *Chlamydophorus* (27, 28). In the last-named form one tendinous intersection was alone noticed. In *Manis* (29) the attachment was from the first to the fifth rib, and in *Orycteropus* (35) the highest rib was also attained. We are not inclined to place much reliance on the number of intersections, as in small mammals these are often very indistinct.

Obliqui abdominis externus et internus.—The former of these muscles was in *Bradypus* (4) attached to the lower ribs, in (7) to the ribs from the 6th to the 14th, and in (6) to the last six. The condition of the internal oblique is only mentioned in the second of these cases, where it is said to have gone to the last rib. *Tamandua* (14) amongst the *Myrmecophagidæ* has the first muscle arising from the fourth rib backward and the second from the last five ribs. Amongst the *Dasypodidæ*, in *Dasypus* (22, 23) the external oblique rises from the ribs from the third to the seventh, whilst in another specimen (24) it is stated to have arisen as high up as the first. In *Chlamydophorus* (27) it rose from the lower six ribs. In *Manis* (29) the external attained the first rib and the internal was attached to the last six. In *Orycteropus* (35) the same high attachment of the external oblique is recorded.

Psoas magnus.—This muscle seems to be always present, though frequently very closely associated with the iliacus, a condition which we think accounts for the fact that in one or two cases it has been reported as absent. It is large and more or less connected with the iliacus in the *Bradypodidæ*, *Bradypus* (4, 5) and *Cholœpus* (10). Amongst the *Myrmecophagidæ* its presence is noted in *Myrmecophaga* (12), *Tamandua* (14), and *Cyclothurus* (17). In none of these cases is any special association with the iliacus mentioned. Amongst the *Dasypodidæ* it arose from the sides of all the lumbar vertebræ in *Dasypus* (22, 23). In *Tatusia* (25) it is described as inseparable from the iliacus, a condition which we think must also have obtained in *Chlamydophorus* (28), where it is stated not to have been found. In another specimen of the same (27) it is said to have been very small, though separate from the iliacus at its origin, where it lay as a thin strip along the side of the ilium. In the account of a third specimen (28 *a*) no mention is made of this muscle, though the presence of the psoas parvus is alluded to. It is therefore probable that here also it was inseparable from the

iliacus. In *Manis* (29, 31, 32) the muscle arose from the transverse processes of the three lower lumbar vertebræ. It is also described as present in *Orycteropus* (35, 36).

Psoas parvus.—This muscle is generally present, and when present always inserted into the ilio-pectineal tubercle as usual. In *Bradypus* (1, 2, 4, 7) it seems always to be a feeble muscle, and usually to come only from the first lumbar vertebra. In *Cholœpus* (10) it is described as present.

Amongst the *Myrmecophagidæ* it is noted as having been present in *Myrmecophaga* (12), *Tamandua* (14), and *Cyclothurus* (17), and in the second of these it arose from the last dorsal and first two lumbar vertebræ. Amongst the *Dasypodidæ* it arose in *Dasypus* (22, 23) from the last dorsal and first two lumbar vertebræ; it was present, though small, in *Tatusia* (25), and is also noted as present in *Chlamydophorus* (27, 28 *a*). In the former of these it is described as a strong muscle. In *Manis* it is always present and strong, generally arising from five lumbar vertebræ (31, 32, 33, 34). In *Orycteropus* (36) it arose from the bodies of the lumbar vertebræ and also slightly from the last rib, and its presence is also noted in (35).

Iliacus.—As has been mentioned above, this muscle is often more or less fused with the psoas magnus. It also not infrequently obtains a much larger insertion into the femur than is the case in human myology. This is the case in *Cyclothurus* (17), *Chlamydophorus* (28 *a*), the proximal third of the femur, *Manis* (32), more than half the femur, *Orycteropus* (35, 36), half the femur. In another animal of the same species figured by Cuvier and Laurillard (37) the iliacus was divided into two bundles, an external and an internal.

Myological Characteristics of the various Families of Edentata.

BRADYPODIDÆ.

1. The dorsal part of the panniculus is feebly marked, and there is no sterno-facialis or sphincter colli.
2. The sterno-maxillaris is absent.
3. The sterno-glossus is absent.
4. The rectus thoracis lateralis is present.
5. The splenius colli is present in *Bradypus*.
6. The rhomboid has no occipital origin in *Bradypus*, though there is one in *Cholœpus*.
7. The subclavius is large.
8. The clavicular deltoid forms a cephalo-humeralis in *Bradypus*, not in *Cholœpus*.
9. *Bradypus* has the middle part only of the coraco-brachialis, *Cholœpus* the short and long portions.
10. *Bradypus* has humeral and glenoid heads to the flexor longus cubiti (biceps), *Cholœpus* the glenoid head only.
11. The extensor cubiti (triceps) has only one scapular head.
12. The flexor carpi radialis does not reach the metacarpus.

13. The palmaris longus is distinct.
14. The flexor sublimis digitorum is absent in *Bradypus*, feeble in *Cholœpus*.
15. The flexor profundus digitorum has no palmar sesamoid.
16. The pronator quadratus is very small.
17. The supinator longus is usually double.
18. The extensor minimi digiti becomes an extensor brevis digitorum and often rises from the carpus or metacarpus.
19. The extensor ossis metacarpi pollicis is inserted into the trapezium.
20. The supinator brevis is inserted into the upper third of the radius. Sometimes it is bilaminar in *Cholœpus*.
21. The caudo-femoralis is fused with ectogluteus.
22. Pectineus is sometimes double in *Bradypus*.
23. The adductor cruris (gracilis) is double.
24. The semitendinosus has only an ischial head.
25. The flexor cruris lateralis (biceps) always has the short femoral head.
26. The tenuissimus is absent.
27. The extensor longus digitorum has a condylar origin and is inserted into the metacarpal bones.
28. The extensor brevis digitorum has a fibular origin in *Bradypus*, tarsal in *Cholœpus*.
29. The peroneus longus never runs across the sole, sometimes it has a femoral origin, sometimes the muscle is absent altogether.
30. The peroneus brevis is sometimes absent.
31. The gastrocnemius has no fabellæ.
32. The plantaris is often absent.
33. The flexor brevis digitorum rises from the calcaneum.
34. The tibialis posticus is single.
35. The accessorius pedis is present.

Myrmecophagidæ.

1. The sterno-maxillaris is present.
2. The sterno-glossus is present.
3. The rectus thoracis lateralis is present.
4. The splenius colli is absent or very slightly developed.
5. The rhomboid has no occipital origin.
6. The subclavius is absent.
7. When there is a coraco-brachialis it is only the long head which is present.
8. The flexor brevis cubiti (brachialis anticus) does not rise from the neck of the humerus.
9. The extensor cubiti (triceps) has more than one scapular head.
10. The flexor carpi radialis reaches the metacarpus.
11. The palmaris longus is usually indistinct or absent.
12. The flexor sublimis digitorum has only one tendon.

13. The flexor profundus digitorum has an extra head from the extensor cubiti. There is no palmar sesamoid in it.
14. The pronator quadratus extends the whole length of the forearm.
15. The supinator longus is usually double.
16. The supinator brevis is inserted into the lower part of the radius.
17. The caudo-femoralis is usually distinct.
18. The adductor cruris (gracilis) is sometimes double.
19. The semitendinosus may be double, the ischial and caudal heads remaining separate, or either one may alone be present.
20. The femoral head of the flexor cruris lateralis (biceps) is usually present.
21. The tenuissimus is present when the last-mentioned head is absent.
22. The extensor longus digitorum is usually femoral in origin, but sometimes tibial.
23. The extensor brevis digitorum always has a tarsal origin.
24. The peroneus longus has no femoral head and its tendon crosses the sole.
25. The gastrocnemius has no fabellæ.
26. The flexor brevis digitorum rises from the calcaneum.
27. The tibialis posticus is double.
28. The accessorius is present.

Dasypodidæ.

1. The panniculus is highly specialized for moving the carapace. There is no definite sterno-facialis (sphincter colli).
2. The depressor mandibulæ (digastric) is absent or small.
3. The sterno-maxillaris is present.
4. The rectus thoracis lateralis is present and deep to the rectus ventralis.
5. The splenius colli is absent.
6. The rhomboideus has a large occipital origin.
7. The subclavius is large.
8. The clavicular deltoid does not unite with the trapezius to form a cephalo-humeral muscle.
9. The coraco-brachialis longus is always present.
10. The flexor longus cubiti (biceps) may have glenoid and coracoid heads (*Dasypus*), or only glenoid (*Tatusia* and *Chlamydophorus*).
11. The flexor brevis cubiti (brachialis anticus) rises from the neck of the humerus.
12. The extensor cubiti (triceps) has more than one scapular head.
13. The flexor carpi radialis sometimes fails to reach the metacarpus.
14. The palmaris longus is indistinct or absent.
15. The flexor sublimis digitorum has only one or two tendons.

16. The flexor profundus digitorum has a large palmar sesamoid developed in it.
17. The lumbricales as a rule are absent.
18. The pronator quadratus is absent.
19. The supinator longus is always absent.
20. The extensor ossis metacarpi pollicis is inserted into the first metacarpal bone.
21. The supinator brevis is small or absent.
22. The caudo-femoralis is separable from the ectogluteus with difficulty.
23. The semimembranosus has a very extensive insertion into the tibia.
24. The femoral head of the flexor cruris lateralis is absent.
25. The tenuissimus is usually present.
26. The extensor longus digitorum never has a femoral origin.
27. The extensor brevis digitorum always has a tarsal origin.
28. The peroneus longus sometimes has a femoral origin and its tendon always runs across the sole.
29. The gastrocnemius has no fabellæ.
30. The plantaris is present.
31. The flexor brevis digitorum is the continuation of the plantaris into the sole.
32. The flexores tibialis et fibularis have a large sesamoid bone in the sole.
33. The tibialis posticus is double.
34. The accessorius pedis is represented only by a fibrous band.

Manidæ.

1. The panniculus is arranged as in a generalized mammal.
2. Sterno-facialis and sphincter colli are absent.
3. The sterno-maxillaris is absent.
4. The sterno-glossus is present.
5. The rectus thoracis lateralis is present and deep to the rectus ventralis.
6. The splenius colli is absent.
7. The clavicular deltoid forms a cephalo-humeralis with the trapezius.
8. The coraco-brachialis is absent.
9. The flexor longus cubiti has only a glenoid head.
10. The flexor brevis cubiti rises from the neck of the humerus.
11. The extensor cubiti has more than one scapular head.
12. The flexor carpi radialis reaches the metacarpus.
13. The palmaris longus is usually distinct.
14. The flexor sublimis digitorum has only one or two tendons.
15. The flexor profundus digitorum has a feeble palmar sesamoid.
16. The pronator quadratus is absent.
17. The supinator longus is present or absent.
18. The extensor ossis metacarpi pollicis sometimes reaches no farther than the trapezium.

19. The supinator brevis is inserted into nearly the whole of the radius.
20. The caudo-femoralis is separable from the ectogluteus with difficulty.
21. The adductor cruris is single or double.
22. The semitendinosus always has a caudal head, though the ischial may be present or absent.
23. The femoral head of the flexor cruris lateralis is present.
24. The tenuissimus is absent.
25. The femoral origin of the extensor longus digitorum is feeble or absent.
26. The extensor brevis digitorum sometimes rises from the fibula.
27. The peroneus longus has no femoral origin and its tendon passes across the sole.
28. The gastrocnemius has no fabellæ.
29. The plantaris is absent.
30. The flexor brevis digitorum rises from the calcaneum.
31. The tibialis posticus is double.
32. The accessorius pedis is present and fleshy.

Orycteropodidæ.

1. The sterno-facialis is well-marked and extends back (caudalwards) superficially to the pectorals to form a sternalis as in *Erinaceus* and *Bathyergus*.
2. The sterno-maxillaris is absent.
3. The rectus thoracis lateralis is absent.
4. The splenius colli is absent.
5. The rhomboideus has an occipital origin.
6. The subclavius is large.
7. The clavicular deltoid is a separate muscle and is inserted into the radius.
8. The coraco-brachialis longus alone is present.
9. The flexor longus cubiti has only a glenoid head.
10. The flexor brevis cubiti rises from the neck of the humerus.
11. The extensor cubiti has more than one scapular head.
12. The flexor carpi radialis reaches the metacarpus.
13. The palmaris longus is indistinct or absent.
14. The flexor sublimis digitorum has four complete tendons.
15. The flexor profundus digitorum has no palmar sesamoid.
16. The pronator quadratus extends over the whole length of the forearm.
17. The supinator longus is present.
18. The extensor ossis metacarpi pollicis is inserted into the trapezium.
19. The supinator brevis is inserted into the upper half of the radius.
20. The caudo-femoralis is fairly distinct.
21. The obturator internus has an intra-pelvic portion.

22. The pectineus is often double.
23. The adductor cruris is single.
24. The semitendinosus has only an ischial head.
25. The femoral head of the flexor cruris lateralis is absent.
26. The tenuissimus is present.
27. The extensor longus digitorum has a femoral origin.
28. The extensor brevis digitorum is always tarsal in origin.
29. The peroneus longus has no definite femoral origin, its tendon passes across the sole.
30. The gastrocnemius has fabellæ.
31. The plantaris is present.
32. The flexor brevis digitorum is continuous with the plantaris in the sole.
33. The tibialis posticus is double.
34. The accessorius pedis is fibrous.

With the object of rendering comparison more easy we have arranged some of the more important muscles in a tabular form (p. 1015).

We have now to consider what lessons may be learnt concerning the relations and systematic position of the animals included in the order of the Edentata from the study of the muscles.

Flower (Proc. Zool. Soc. 1882, p. 358), in a paper on the mutual affinities of the animals composing this order, says that "the two Old-World forms *Manidæ* and *Orycteropodidæ* are so essentially distinct from all the American families, that it may even be considered doubtful whether they are derived from the same primary branch of mammals, or whether they may not be offsets from some other branch, the remaining members of which have been lost to knowledge." In using the muscles in the endeavour to deal with this problem, the first consideration necessary is to ascertain whether there are any departures from the generalized arrangement of mammalian muscles which are common to all the families of this so-called order, for, if such exist, they are not likely to be adaptations to similar conditions of life in animals far removed in relationship. For instance, if similar wanderings from the generalized mammalian arrangement of muscles can be found in the Pangolin and the Sloth, these wanderings are more likely to be the result of kinship than of an adaptive modification to meet similar conditions of life, for few animals more dissimilar in their habits could be imagined than these two. Everyone who has worked at Edentate myology will at once think of two curious muscular modifications which are not usually found elsewhere amongst the Mammalia, namely, the rectus thoracis lateralis and the femoral head of the flexor cruris lateralis, or biceps. Both these muscles are present in the two families, although, so far as we know, the rectus thoracis lateralis is never found as a distinct muscle outside the order with which we are now concerned, whilst the short head of the flexor cruris lateralis is only to be seen in the Edentates, Platyrrhine Monkeys, and Anthropoids. There are other peculiarities

	Bradypodidæ.	*Myrmecophagidæ.*	*Dasypodidæ.*	*Manidæ.*	*Orycteropodidæ.*
Sterno-maxillaris	Absent.	Present.	Present.	Absent.	Absent.
Rectus thoracis lateralis.	Present.	Present.	Present.	Present.	Absent.
Fl. brev. cubiti (Brach. ant.) from neck of humerus.	Seldom.	Never.	Always.	Always.	Always.
No. of scapular heads of ext. long cubiti (Triceps).	One.	More than one.	More than one.	More than one.	More than one.
Pronator quadratus	Very small.	Whole of forearm.	Absent.	Absent.	Whole of forearm.
Supinator longus.....	Usually double.	Usually double.	Absent.	Present or absent.	Present.
Ext. brev. dig. from carpus.	From carpus.	Occasionally from carpus.	Not from carpus.	Not from carpus.	Not from carpus.
Adductor cruris	Double.	Sometimes double.	Single or double.	Single or double.	Single.
Femoral head of Flex. cruris lateralis (Biceps).	Always present.	Usually present.	Absent.	Present.	Absent.
Tenuissimus.....	Absent.	Usually absent.	Usually present.	Absent.	Present.
Condylar origin of Ext. long. dig.	Present.	Usually present.	Absent.	Feeble or absent.	Present.
Fibular origin of Ext. brev. dig.	Present in *Bradypus*.	Absent.	Absent.	Sometimes present.	Absent.
Fabellæ in gastrocnemius.	Absent.	Absent.	Absent.	Absent.	Present.
Flex. brev. digitorum.....	From calcis.	From calcis.	Continuous with plantaris.	From calcis.	Continuous with plantaris.
Tibialis posticus	Single.	Double.	Double.	Double.	Double.
Accessorius	Fleshy.	Fleshy.	Fibrous.	Fleshy.	Fibrous.

common to the two animals, such as the total absence of fabellæ from the gastrocnemius, the occasional presence of a fibular origin for the extensor brevis digitorum pedis, and the absence of the sterno-facialis (sphincter colli) part of the panniculus, which are not so striking as the former two, but which, taken together, are enough to make us think that there is a closer kinship between the Sloths and the Pangolins than they are generally supposed to possess. It would be easy to pick out points of similarity between the Sloths, Ant-eaters, and Armadillos by reason of which they differ from the generalized mammalian type, and which clearly point to their near relationship with one another; it would also be easy to indicate by means of its muscles that, although *Manis* cannot be a very distant relation of the *Bradypodidæ*, it is more closely allied to the *Myrmecophagidæ* and *Dasypodidæ*. When we come to consider the *Orycteropodidæ*, however, we are more struck with the generalized mammalian arrangement of its muscles than by any special edentate characteristics; the three points on which we laid so much stress in claiming a place for the Pangolins in the Edentate order are wanting in the Aard-vark. There is no rectus thoracis lateralis, no femoral head to the flexor cruris lateralis, and it has fabellæ in its gastrocnemius just like any other mammal. In addition to this the sterno-facialis, which in all other Edentates is suppressed, is very strongly marked and covers a part of the pectorals as in *Erinaceus* among the Insectivora and *Bathyergus* among Rodentia. There are, however, a few points in which the Aard-vark differs from most mammals and resembles the Edentata. One of these is the presence of more than one scapular head for the extensor cubiti (triceps), and another is the double tibialis posticus. We have never yet seen either of these arrangements in any other mammals but the Edentates; and we cannot help regarding this animal as a link between the Edentates and the more generalized stock from which that order has diverged. We have read with much interest a paper by Dr. Elliot Smith (Trans. Linn. Soc., 2nd ser. Zool. vol. vii. pt. 7, p. 387) in which he says that "if the brain of *Orycteropus* were given to an anatomist acquainted with all the other variations of the mammalian type of brain, there is probably only one feature which would lead him to hesitate in describing it as an exceedingly simple Ungulate brain." Changing the word muscles for that of brain, this is practically our own view. There are only one or two points which would cause us to hesitate in describing *Orycteropus* as a generalized type of mammal, but these one or two are certainly in an edentate direction. We further read (ib. p. 390) that *Manis* has certain cerebral features which point to a relationship with the American Edentate group; a statement which strongly confirms the view which we have already expressed.

Taking all these facts into consideration, we think that the systematists do well to retain the order of Edentata, although the name is certainly a misguiding appellation. We also think that it is not wise to lay too much stress on the articulations of the

vertebræ of the American forms, and to press these into a separate order of *Xenarthra* to the exclusion of the *Manidæ*. The *Orycteropodidæ*, too, present some feeble claim to be taken into the order, for, generalized though they are, their muscular peculiarities seem to point, so far as we at present know, more towards the Edentata than to any other group of mammals.

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2. Contributions to the Osteology of Birds. Part IV. *Pygopodes*. By W. P. Pycraft, A.L.S.

[Received September 11, 1899.]

(Plate LXXII.)

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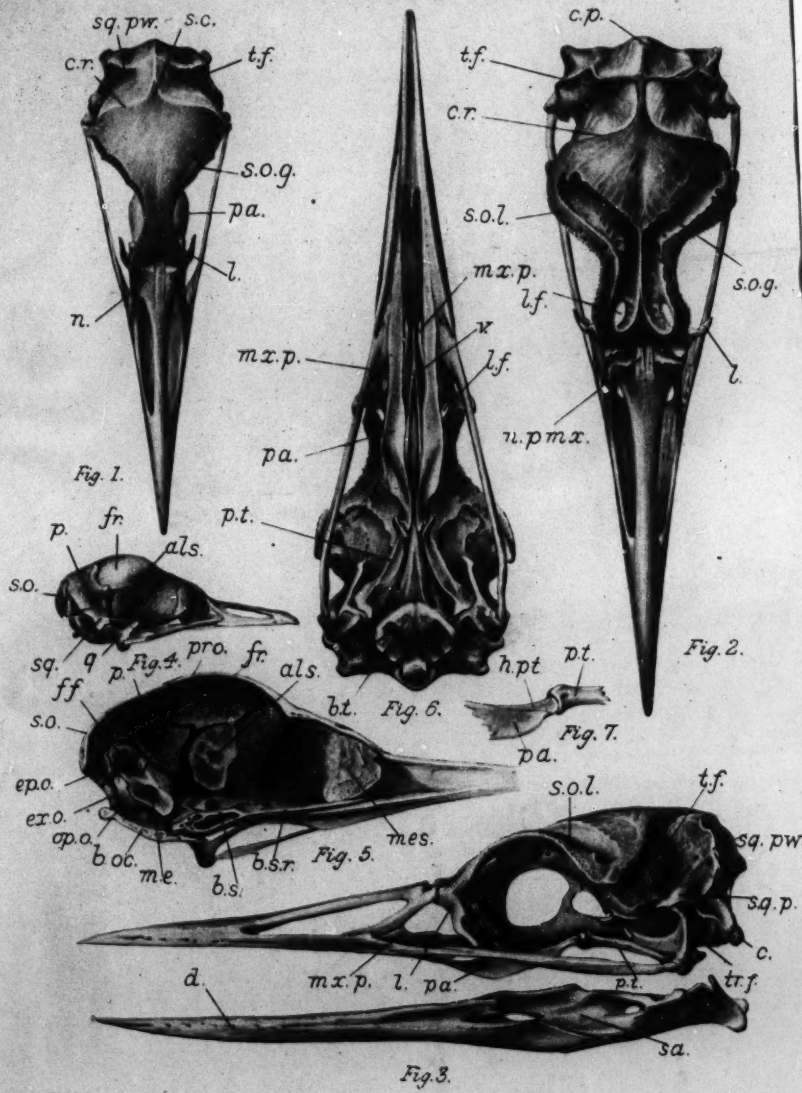
i. Introductory Remarks.

The following account of the Osteology of the Grebes and Divers is offered as a supplement to the very valuable memoirs of Brandt, Beddard, Milne-Edwards, Fürbringer, Gadow, Garrod, D'Arcy Thompson, and others, to which the present writer is greatly indebted. Although, perhaps, few of the facts herein set down are really new, it is hoped that the method of their presentation may succeed in bringing to light points which have hitherto escaped notice. As usual, this work is based upon a study of the skeletons in the Natural History Museum. These are fairly numerous, but some genera of Grebes yet remain on our lists of desiderata. I am especially indebted to Mr. Beddard for the loan of a skeleton of *Æchmophorus*, which is as yet unrepresented in the Collection.

We have no embryos either of Grebes or Divers; hard-set eggs of these would therefore be very acceptable. The only nestling-skeletons of this suborder which we possess are two of *Podicipes cristatus*, kindly furnished for the purposes of this paper by the Hon. Walter Rothschild, M.P.

My description of the hemipterygoid of the Diver is based upon two nearly full-grown skulls, one of which was kindly lent me by Prof. G. B. Howes, F.R.S. Nestlings of the Diver are badly needed. We should be grateful for help in this direction from members of this Society, some of whom doubtless could fill up for us these gaps.

Comparison is frequently made, throughout this paper, between the Auks and Divers. This is in no sense to be taken as a suggestion that these two forms are in any way related. The points wherein the two resemble one another are many, but they are to be regarded as instances of convergence, brought about by similar habits of life. It is intended to make such comparisons a special feature of this series of papers, in order that they may be of real use to the working osteologist and palæontologist, both of whom are frequently called upon to decide to which of two forms



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OSTEOLOGY OF THE PYGOPODES.

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a given bone belongs, when only that portion of the skeleton, as frequently happens, comes up for determination.

ii. The Skull of the Adult.

The skull of the Pygopodes resembles on the one hand that of the Alcidæ and the Penguins, and on the other the Rails. Its resemblance to the two former rests chiefly upon the structure of the palate, which in all is schizognathous, and of the deep supra-orbital grooves, when these are present. It can at once be distinguished from the Alcidæ by the holorhinal nares, which in the Alcidæ are schizorhinal, and from the Impennes by the rod-shaped pterygoids, the inflated basitemporal platform, the laminate maxillo-palatine processes, and the great width and shallowness of the temporal fossa, when present. Its resemblance to the Rails is confined to the smaller Grebes, and in these it is very striking. The skull of the Grebe, however, is always to be distinguished from that of the Rail by the conspicuous development of a cerebellar prominence, similar to that of the larger Grebes, the Divers, Penguins, and Auks. At the base of this prominence is a well-marked deepening of the posterior region of the temporal fossa which is never found in the Rails, where the fossa is only barely indicated by a very shallow depression.

The Occipital Region.—The occipital condyle is more or less reniform in the Grebes and hemispherical in the Divers, though even here the flattened upper surface is slightly hollowed. The form and development of the paroccipital processes resemble those of the Penguins; they pass upwards into the lambdoidal crest and forwards into the squamosal prominence. In the smaller Grebes these processes are but feebly developed, being represented only by small and somewhat inflated bosses laterad of the base of the foramen magnum. In the Grebes, caudad of the inner end of the lip or interior free border of the process is a deep groove which is not present in the Divers. The supra-occipital is not pierced by lateral fontanelles, but there is a small median foramen above the foramen magnum in the Divers; this is wanting in the Grebes, and the cerebellar dome—formed by this bone—is marked by a more or less well-defined median vertical ridge, or low keel, forming a supraoccipital crest, differing in this respect from both Penguins, Petrels, and Auks. This crest joins the median sagittal crest, dividing the temporal fossæ, at the lambdoidal ridge.

The squamoso-parietal wings, in the Divers, rise in the form of sharp lateral ridges for the whole height of the skull as in many Penguins, terminating in the middle line in a more or less diagonal expansion, which passes forwards into the median sagittal crest. The free edges of these wings give a sharply defined crescentic outline to the skull when seen from behind. These wings, as in the Penguins, occupy the position of the lambdoidal ridge.

In the Grebes, the squamoso-parietal wings do not attain to the height of the skull. In the larger species they cease abruptly at about halfway, a thin raised ridge running upwards from this point to the sagittal crest representing the lambdoidal ridge. In the smaller Grebes the squamoso-parietal wings are feebly developed. As in the larger species, the lambdoidal ridge is represented by a thin raised line, terminating at the sagittal crest.

The Roof of the Cranium.—The parietal region in the Divers and larger Grebes is impressed by wide but shallow temporal fossæ, divided, in the fully adult bird, by a narrow sagittal crest (Plate LXXII. fig. 1). It is interesting to note that in a nearly full-grown skull of *Colymbus septentrionalis* in the Museum Collection this crest (Plate LXXII. fig. 2) is represented by a broad plate of bone, whilst in an immature *C. glacialis*, apparently a little younger than that of *C. septentrionalis*, inasmuch as some sutures are yet distinct, the sagittal crest is as sharply defined as in the adult.

In the larger Grebes the sagittal crest is sharply defined, as are the temporal fossæ. In the smaller species the anterior boundary-line of the temporal fossa is barely visible, posteriorly the fossa is moderately deep. The form of the fossa differs from that of the larger species and Divers, in that it is relatively shorter from before backwards, the cerebellar region of the skull only slightly projecting backwards beyond the cerebral. In the former the backward extension of the cerebellar prominence is very marked, more so than in the Penguins and Petrels.

The *supraorbital grooves* of the frontals in the Divers are separated by a median knife-like edge; externally, they are bounded by a broad supraorbital ledge the free edge of which is flattened, as in many Penguins. Anteriorly, the supraorbital ledge fuses with the posterior-dorsal limb of the lachrymal on either side. The anterior inner border of the ledge, immediately behind the lachrymal, is pierced by a large foramen for the passage of the lachrymal duct.

In the Grebes, the supraorbital region of the frontals is marked by a wide shallow median furrow; supraorbital grooves can hardly be said to exist, being represented only by a faint excavation along the free edge of the frontal.

The supraorbital ledge, in the Divers, posteriorly combines with the alisphenoid, to form a prominent postorbital process. In the Grebes, this process is only very feebly developed; moreover, this region of the skull differs markedly in the two forms, in that, in the Divers the postorbital process is continued forwards as the supraorbital ledge, whilst in the Grebes the region in front of this process is marked by a shallow depression for the insertion of the muscles of the jaws. *Æchmophorus* seems to be the only Grebe to which the above remarks do not apply; in this genus the periphery of the fossa lodging the muscle is produced outwards into a broad shelf-like emarginate postorbital process.

The Base of the Skull.—The basitemporal plate of the parasphenoid is markedly inflated, and has a bevelled anterior border, the free edge of which, in the Divers, is overhung by a downgrowth from the alisphenoidal wings of the parasphenoid. This, in the Grebes, by its fusion with the free edge of the basitemporal plate, forms a pair of closed tubes opening on either side of the skull, behind the quadrate, and below the squamosal prominence into the aperture which serves also as the mouth of the tympanic cavity. The inferior and posterior of these two runs transversely across the skull, and forms the Eustachian tubes of the right and left sides of the head. The connection with the choanæ is by means of a single median aperture immediately under the rostrum. The anterior runs forward as a pneumatic cavity into the body of the parasphenoid to terminate beneath the level of the foramen opticum. In the Divers, the form of this aperture is tubular, recalling that of the Penguins, the anterior wall of the tube being continued outwards behind the squamosal, but in the Grebes the anterior wall is deficient.

Mammillary processes are but feebly developed; in the Divers the paroccipital notch is wide and shallow, it can scarcely be said to exist in the Grebes. There is a precondylar fossa, or rather groove, in the larger species of both families.

The parasphenoid rostrum, in both Grebes and Divers, is somewhat inflated at the base, owing to the presence of the pneumatic cavity already described.

The Lateral Aspect of the Cranium (Plate LXXII. figs. 3-6).—The tympanic cavity has a sharply defined aperture in the Divers (Colymbi), by reason of the considerable lateral development of the alisphenoidal wing of the parasphenoid. Within its mouth can be seen, distad, two large apertures, lying immediately behind the alisphenoidal wing just referred to: the upper is the pneumatic aperture of the parasphenoid, the lower is the Eustachian aperture; caudad, and separated by a broad column of bone, lie the fenestra ovalis and the fenestra rotunda.

The *temporalis recess*[1], so well developed in the Steganopodes and Petrels, and to a lesser degree in the Penguins, is here represented only in the Divers, by a moderately deep fossa; in the Grebes it is wanting. The posterior pneumatic cavity opening downwards, behind and above the *fenestra ovalis*, so well developed in the skull of the Tubinares, is wanting in both Grebes and Divers.

[1] In my recent paper on the Osteology of the Penguins the temporalis recess was described as "leading eventually, in the dried skull, into the cranial cavity." This is quite a mistake. The correct interpretation of this is as follows:—In many skulls, e. g. *Puffinus*, above the trigeminal there lies a second foramen for the sinus transversus of the vena cephalica posterior—at times this is confluent with that for the trigeminal, *e.g.* Divers—and both these lie immediately outside, below and mesiad of the mouth of the recess in question. In the Penguin the foramen supplementary to the trigeminal lies immediately within the mouth of the recess, piercing its inner wall; owing to imperfect ossification, the mouth of the foramen in the dried skin extends upwards nearly the whole length of the recess.

The tympanic cavity in the Grebes is not so sharply defined as in the Divers, owing to the slighter development of the alisphenoidal wing of the parasphenoid; in other respects, however, it closely resembles that of the Divers.

The *squamosal prominence* is only concerned with the suspension of the quadrate and does not, in addition—except very imperfectly, and only in the Divers—form the roof of a temporalis recess, as in the Tubinares and the Impennes. The paroccipital processes are well developed in the Colymbi, forming, as in the Impennes, a backward continuation of the squamosal prominence; in the Grebes (Podicipides) these processes are feebly developed, being represented only by an abruptly truncated lamina of bone.

The temporal fossæ.—In the Colymbi (Divers), and in the larger Podicipides (Grebes), the temporal fossæ are very wide and shallow and sharply defined. They are separated in the mid-dorsal line only by a sharp median sagittal crest. Within the confines of the fossa, on each side, are defined the limits between the cerebral and cerebellar regions of the skull, the squamoso-parietal wings running transversely across the cerebellar dome, as in the Petrels, and not, as in the Penguins, traversing the boundary line between these two regions. In the smaller Grebes, e. g. *Tachybaptes*, the temporal fossa is only faintly defined, moreover it is almost entirely confined to the cerebral, and extends scarcely at all on to the cerebellar dome. This is due, not to any essential difference in the form or position of the fossa, but to the extremely slight development of the last-mentioned dome.

The *trigeminal foramen*, in the Divers, lies immediately outside the inner wall of the mouth of the fossa representing the temporalis recess. There is no foramen for the sinus transversus branch of the *vena cephalica posterior* above this as in the Penguins and Petrels. In the Grebes the trigeminal and the venous foramen immediately above are confluent; it pierces the wall of the alisphenoid immediately in front of the articular surface for the head of the quadrate and below the anterior border of the squamosal prominence. It lies relatively further forwards than in the Divers, inasmuch as, in the Grebes, this foramen and the anterior border of the squamosal prominence lie only a short distance behind a vertical line passing through the postorbital process; in the Divers both these points lie far behind this line.

The *orbits*, in the Divers, are overarched by the supraorbital ledges, the postorbital process bounding them posteriorly and the lachrymal anteriorly. The perforated interorbital septum forms a mesial partition-wall.

In the Grebes the supraorbital ledges and postorbital processes are wanting, and the lachrymal is very small, so that the orbit in this group is not nearly so well defined. An osseous interorbital septum is wanting; in the Divers a large extent of the middle region is supplied by membrane, so that in the dried skull the septum is largely fenestrated.

The *orbitosphenoid* in the Divers is completely ossified; in the Grebes this is largely represented by membrane, so that the anterior wall of the brain-case in the dried skull bears a more or less considerable fenestra. In a skull of *Æchmophorus* kindly lent me by Mr. Beddard this fenestra is very small, the orbitosphenoid is ossified dorsad so as to close in and form tubes for the olfactory nerves as they leave the brain.

In the Divers the interorbital septum forms a vertical bar in front of the optic foramen, this is wanting in the Grebes.

The ethmoidal region.—The mesethmoid is indistinguishably fused with the presphenoid (=interorbital septum) behind, and the parasphenoidal rostrum below; it expands dorsally as usual into a pair of lateral aliethmoidal plates under the nasal and frontal bones, the free edges of which curve slightly downwards under the outer border of the frontal and along the inner border of the lachrymal. Its postero-dorsal border is continued backwards to terminate in a sharp, spinous, crista-galli forming a median partition between the olfactory nerves.

The antorbital plate in the Divers is represented by a thin ridge of bone running from the mesethmoid outward and forward to the lachrymal. In the Grebes this is represented by a narrow band-shaped scroll of bone from the lower and hinder border upwards to the nasal, immediately to the inner side of the dorsal end of the lachrymal.

A comparison may profitably be made here between the mesethmoid of the Pygopodes and that of the Impennes and Tubinares. In the two first mentioned groups the mesethmoid is relatively smaller than in the last, and only very slightly pneumatic.

In the Divers and Grebes its anterior border curves gently forwards, carrying with it a pair of lateral wing-like ridges, the whole eventually terminating in a sharply truncated border running transversely across the skull immediately under the free end of the nasal processes of the premaxilla. Its posterior border is deeply hollowed by the interorbital fenestra. Its dorsal border, anteriorly, expands into a pair of lateral aliethmoidal plates, tapering from before backwards; posteriorly it runs backwards, in the Divers in the form of a deep, and in the Grebes in the form of a very narrow knife-like ridge, the free end of which terminates as a pointed "crista-galli" within the olfactory fossa.

In the Impennes the form and relations of the mesethmoid closely resemble those of the Pygopodes.

In the Tubinares, the *mesethmoid* differs from the forms described on account of the fact that its upper and lower regions are brought into sharp contrast by reason of the great pneumaticity of the lower region, which causes the upper non-pneumatic half, with its gently arched aliethmoidal wings, to assume a cavern-like form, which passes backwards in a tubular manner into the olfactory fossa. Moreover, the crista-galli takes the form of a median pillar dividing two large tubular apertures for the olfactory crura; whilst in the other forms the crista-galli is

reduced to a spine-like process dividing two greatly reduced passages for the olfactory nerves, the crura lying caudad of the crista, and not passing on either side.

The *alicthmoids* are the only ectoethmoidal ossifications in either the Impennes, Tubinares, or Pygopodes. They constitute the antorbital plates. In the Colymbi, when present, they resemble in form those of the Tubinares—plates of bone jutting out from the mesethmoid to the lachrymal, sloping obliquely forwards and downwards. They appear, however, in the Colymbi to be but rarely ossified, and never so well developed as in the Tubinares. In the Podicipides their true nature is well seen. Here, they appear as scroll-like bars of bone running continuously backwards, downwards, and inwards from the expanded dorso-lateral plates of the mesethmoid itself, to pass eventually into the middle of its posterior border.

The *olfactory chamber* is of comparatively small size.

The *lachrymal* in the Podicipides is free, small in size, roughly semilunar in shape—with the convex border forwards—and apparently a disappearing structure. It articulates by its superior limb with the outer border of the nasal bone. Though conspicuous from a lateral view, it is scarcely if at all visible from the dorsal aspect of the skull.

In the Colymbi, the lachrymal is roughly of the same shape as in the Podicipides; but it differs therefrom, markedly, in several points. Its superior limb, as in the Grebes, articulates with the nasal; but it is free only in the young bird, later it becomes indistinguishably fused with that bone; moreover, it sends backwards a long spur to fuse with the supra-orbital ledge, and to enclose with its aid a passage for the lachrymal duct, as in many Alcidæ. Its lower limb, at its free end, is more or less markedly sigmoidally curved. It is, on the whole, a larger and stronger bone than in the Grebes.

The Cranial Cavity.—The *metancephalic fossa* of the Pygopodes is relatively both longer and shallower than in the Impennes and Tubinares, but is deeper in the Grebes than in the Divers. The *vagus foramen* occupies relatively the same position as in the two last mentioned groups; the two condyloid foramina, similarly, lie mesio-caudad of this.

The *internal auditory meatus* lies immediately under the mouth of the floccular fossa and in front of the vagus foramen. The *abducent foramen* pierces the anterior border of the fossa, passing on either side of the pituitary fossa, and emerging in the Grebes within the rim of the ventral border of the optic *foramen*, and in the Divers caudad of the foramina for the oculomotor nerve and internal ophthalmic artery.

The *cerebellar fossa* agrees with the Tubinares, and differs from the Impennes, in its greater relative size. It lacks, however, the transverse system of grooves and ridges representing the cerebellar sulci and gyri so marked a feature in this region of the skull in the Tubinares.

The *mesencephalic fossa* agrees with that of the Tubinares, in that the groove for the sinus transversus branch of the vena cephalica posterior (pp. 1021–2) appears as a deep tunnel excavated out of the inner wall of the skull. It runs upwards, backwards, and downwards, following the curve of the anterior semicircular canal, finally piercing the wall of the supra-occipital tunnelwise, leaving the skull by a small aperture on either side of the foramen magnum, but much lower down than in the Impennes or Tubinares. The Pygopodes differ from the two last mentioned groups in that this cephalic vein enters the skull through the trigeminal foramen, and not by a separate aperture. The floor of the fossa bears a deep groove for the orbito-nasal nerve.

The *pituitary fossa* differs conspicuously both from that of the Impennes and of the Tubinares by its peculiar shallowness. In the Colymbi it forms a moderately deep pit sloping gently backwards; but in the Podicipides it is represented only by a very slight oblong depression, bounded on either side by a strong ridge forming a tunnel for the abducent nerve. This pituitary ridge, from the point where the nerve enters, is continued upwards and outwards, to terminate at the groove for the cerebral vein, already described. This second ridge forms the posterior boundary line of the mesencephalic fossa. There is a well-developed *dorsum sellæ* and prepituitary ridge in the Colymbi, the latter flattened to form an optic platform. The pre-optic, as usual, passes on either side into the tentorial ridge.

In the Podicipides there is no *dorsum sellæ*, the internal carotid apertures opening directly on to the floor of the fossa.

The *optic foramen* in the Colymbi is bounded in front by a vertical plate of bone, being that part of the interorbital septum bounding the interorbital fenestra posteriorly. This plate is wanting in the Podicipides.

The *cerebral fossæ* in the Divers and Grebes closely resemble one another, they both agree in that this region of the brain-cavity is greatly depressed dorso-ventrally, as in the smaller Tubinares. The tentorial ridge is sharply defined, particularly so in the Divers. The bony falx, which dips down between the pallial fissures of the brain, is not so strongly marked as in the Tubinares. There is only the faintest indication of the bony ridge marking the position of the Sylvian furrow such as is found in the skull of *Diomedea*, and this is entirely dorsal, and not lateral as in *Diomedea*. Again, the tentorial ridge of the Pygopodes and smaller Tubinares lies horizontally to the long axis of the skull; whilst in *Diomedea*, for instance, it is almost vertical in position.

The *olfactory fossæ*, like those of the Impennes, are extremely small, and pass insensibly into the cerebral fossæ behind; wherein they stand strongly contrasted with the large tubular chambers of the Tubinares. They are divided in the middle line, forwards, by a small knife-like *crista-galli*. In the Tubinares, it will be remembered, this crista-galli is columnar.

The Premaxilla, Nasal, and Lachrymal.

The naso-premaxillary region of the upper jaw bears a strong superficial resemblance to the Alcidæ on the one hand, and certain genera of Penguins on the other, *e. g.* that of *Megaeudyptes*. It may readily be distinguished from the former by the form of the nostrils, which are schizorhinal in the Alcidæ; from the latter, apart from the rest of the skull, it would be difficult to distinguish it.

The *nasal*, in the adult, both in the Colymbi and Pygopodes is completely fused with the premaxilla and frontals. In the Divers it is, furthermore, fused with the outer border of the lachrymal. It is not deeply cleft caudad, the form of the external narial apertures being holorhinal; they are also, by the way, in the dried skin pervious, there being no nasal septum.

The *lachrymal* is a fairly large bone in the Colymbi, with a peculiar notch in the posterior border of its free end; in the Podicipides, as elsewhere remarked (pp. 1024, 1031), it shows signs of degeneration.

The Maxillo-jugal Arch.

The *maxilla*, in the adult of both Grebes and Divers, is indistinguishably fused with the premaxilla. The maxillo-palatine processes are Charadriiform in type, closely resembling those of the Alcidæ, being leaf-shaped, and in the Colymbi more or less fenestrated. The *antrum* is very shallow. They are widely separated in the middle line, and the palate is therefore schizognathous.

The form of these processes rather closely resembles that of the smaller Tubinares, e. g. *Pelagodroma*, *Procellaria*, but differs markedly from that of the larger forms, such as *Puffinus* for instance. In these, it will be remembered, the maxillo-palatine processes do not extend backwards into the lachrymo-nasal fossa, and are hollowed out to form a spacious *antrum of Highmore*.

The anterior end of the maxillo-jugal arch does not trend upwards to meet the lachrymal, as in many Procellariidæ, but the lower limb of the lachrymal in the Colymbi is very long, so much so as nearly to touch the bar, and thus to completely shut off the triangular lachrymo-nasal fossa from the orbit. The greater part of this arch is made up by the quadrato-jugal bar.

The Vomer, Palatine, and Pterygoid.

The *vomer* in the Colymbi appears to be free throughout life; in really adult or advanced Podicipides it fuses with the palatines.

In the Colymbi it somewhat closely resembles that of the Diomedeidæ, appearing knife-shaped from below and provided with a pair of lateral wings along its dorsal border. It differs from this type, however, in that it lacks the conspicuous dorso-ventral curve. Its dorsal aspect is trough-like, and posteriorly lodges the anterior end of the parasphenoidal rostrum.

In the Podicipides it is knife-like, and lacking the lateral wings,

when seen from below. From the dorsal aspect, the trough-like region is found to be restricted to the posterior end, immediately underlying the anterior end of the rostrum.

The *palatine* (Plate LXXII. fig. 7), in its general form, and in its relations with the vomer and maxillo-palatine processes, somewhat closely resembles that of the Alcidæ. It differs conspicuously from that of the larger Tubinares in its greater relative length, and in the feebler development of the paired median and lateral keels formed by the inner and outer borders of the palatine caudad of the maxillo-palatine processes. Its general contour, from the ventral aspect, may be described as rod-shaped, in front of the maxillo-palatines, passing behind these into a shallow trough-like expansion. Seen dorsally, the inner free edge of the expanded portion, cephalad, rises dorsally into a scroll-shaped plate to articulate mesially with the vomer. Seen laterally, this scroll-like dorso-lateral plate does not fit closely up to the posterior border of an almost vertical maxillo-palatine process as in the Tubinares, but leaves a large space between.

The *pterygoid* is rod-shaped, and more or less triangular in section. That of the Colymbi sends outwards, from the outer border of its extreme proximal articular end, a small plate to abut against the base of the orbital process of the quadrate. Moreover, it still further differs from that of the Podicipides, (1) in that it possesses a strong inward curve, causing the pterygoids to embrace the parasphenoidal rostrum, as in many Procellariæ, from which it differs, however, in that no glenoid articular surface is developed for this purpose; and (2) in that it sends forward and upward, from the external ventral border of its extreme distal end, a delicate claw-like process, to embrace the articular end of the palatine—or more correctly of the anchylosed hemipterygoid. This point was first noticed by Coues (3).

The *quadrate* more nearly resembles that of the Tubinares and Impennes than that of the Alcidæ. It differs from all in the very elongated and rod-like form of its orbital process. Its otic and squamosal heads are sharply divided. The glenoid mandibular surface nearly resembles that of the larger Tubinares. Its external condyle is hollowed from before backwards; its internal condyle may be divided into relatively large anterior and posterior facets, meeting one another in the mid-ventral line. Immediately dorsad of the posterior facet of the internal condyle is a sharply defined pterapophysial facet for the articulation of the pterygoid. It is non-pneumatic both in the Grebes and Divers, in which point it agrees with both Impennes and Alcidæ, and differs from the Tubinares, in which it is pneumatic

The Mandible.

Is slender, elongated, and slightly recurved at the tip. It can be more or less readily distinguished from that of other groups—such as some Ardeidæ, which it somewhat closely resembles—by the

form of the coronoid. This is long, narrow, and pointed. Its anterior half remains distinct throughout life, the posterior region fuses with the angulare. The dentary suture also remains distinct.

In the Divers the supra-angular is pierced by a large foramen, which remains permanently open: furthermore the jaw may be distinguished from that of the Grebes by a deep notch situated immediately behind the outer border of the glenoid surface for the external condyle of the quadrate; in this last it agrees with many Alcidæ. The internal angular process is feebly developed.

The mandible of the Podicipides (Grebes) lacks the notch just described, and the foramen piercing the supra-angular is much reduced in size, and shut off from within by the base of the coronoid; the internal angular process is moderately well developed.

The Hyoid.

The *hyoid* of the Pygopodes differs markedly from that of the Alcidæ, both in the form of the basihyal and basibranchial ossifications, neither do they bear any close resemblance either to those of the Tubinares or of the Impennes. In each of the three last-mentioned groups the first and second basibranchials are anchylosed, the latter being continued backwards in the form of a median pointed bony style between the ceratobranchials to form the "urohyal." In the Pygopodes the first and second basibranchials appear to remain distinct throughout life.

In the Pygopodes the first basibranchial—the main body of the bone—takes the form of an oblong plate hollowed dorsally, and with a slight median keel ventrally. The basihyal is partly ossified, the ceratobranchials are relatively very long, the epibranchials short and slender.

In the Colymbi the first basibranchial takes the form of a flattened oval, and the anterior region of the ventral median keel is strongly developed. The second ("urohyal") is apparently but imperfectly ossified, only the very centre of the rod-shaped style being bony. In the Museum skeletons there is no basihyal ossification, but this may have been lost in maceration.

iii. The Skull of the Nestling.

For the nestling which forms the subject of the following notes I have to thank the Hon. Walter Rothschild, who kindly provided it specially for this purpose.

a. *Cartilage-bones.*

The *basioccipital* seen externally is linguiform; it forms the central portion of the occipital condyle posteriorly, and anteriorly is underfloored by the basitemporal plate of the parasphenoid. It joins the exoccipital by harmony suture. Internally it is bounded laterally by the exoccipital and anteriorly by the basisphenoid.

The *exoccipital*.—Externally it is bounded supero-internally by the supraoccipital, and supero-externally by that portion of the proötic cartilage which lodges the floccular fossa. Its internal border is <-shaped. The posterior limb is free and bounds the foramen magnum, the anterior runs along the outer border of the basioccipital. Its external border has fused with the proötic cartilage, the boundary between the two being indicated by a notch superiorly. The vagus foramen pierces it near its centre. Internally, it is largely concealed by the opisthotic, only its inner half being visible. The vagus foramen appears on this side at the base of the opisthotic, and indicates how much of the exoccipital is concealed by this bone.

The *supraoccipital* is cleft in the middle line superiorly for more than half its length. Its ventri-lateral border is fused with the epiotic, but the distinction between the two bones can yet be made out. Its internal does not differ much from its external form.

The *proötic* appears externally in the form of an oblong mass of cartilage separating the squamosal from the anchylosed opisthotic and exoccipital bones. Internally its size is seen to be considerable. Supero-dorsally it is notched to form the inferior border of the floccular fossa. Its outer half lies immediately in front of the squamosal, which bone it almost entirely shuts out from the inner surface of the cranium, only a small semicircular strip of about ½ mm. being visible, and forming the floor of a groove separating the proötic from the parietal and alisphenoid bones. Its antero-ventral border is linguiform and imbedded in a mass of cartilage. Its inner lateral border is in part (superiorly) fused with the opisthotic and in part (inferiorly) imbedded in cartilage in common with the linguiform anterior end. The meatus internus is very deep.

The *epiotic* is only ossified at its junction with the supraoccipital; the rest of the posterior vertical semicircular canal is yet cartilaginous, and forms the superior boundary of the floccular fossa.

The *opisthotic* has almost completely fused with the proötic, but traces of the original suture still remain. It fuses posteriorly with the exoccipital. The vagus foramen passes between its antero-internal border and the exoccipital in front. There is no trace of the opisthotic visible externally.

The *basisphenoid* is not visible externally, being underfloored by the parasphenoidal rostrum and its basitemporal plate, with which furthermore it has now completely fused. Below the pituitary fossa, and that portion of the basisphenoid immediately behind it, is a large air-sinus, and this forms the only indication of the division between the para- and basisphenoidal regions. The pituitary fossa forms a moderately deep pit. The dorsum sellæ is yet membranous. In the adult the pituitary fossa seems to have become almost obliterated (p. 1025). Immediately behind the pituitary fossa the basisphenoid is marked by a deep <-shaped notch, dividing a median portion from a pair of lateral wings. The membrane stretched between the two wings forms the dorsum

sellæ. This arrangement suggests an ossification of the basisphenoid from three centres—a median longitudinal, running forward to lodge the pituitary fossa, and two lateral wings. This is a point for further investigation on fresh material.

The basisphenoid is bounded laterally by the alisphenoid, postero-laterally by the proötic, and posteriorly by the basioccipital, and anteriorly by the presphenoid.

The *alisphenoid* has partly fused with the orbital process of the frontal, but is otherwise at present free. Externally it is roughly circular in form. The posterior convex border follows the outline of the concave anterior border of the squamosal, but the two borders do not as yet even touch. Neither has the ossification of its ventral border extended downwards as far as the parasphenoid.

The *orbito-* and *presphenoids* have not as yet begun to ossify. They are represented only in the dried skeleton by a thin transparent sheet of tissue—the remains of the original cartilage.

The *mesethmoid* is almost completely ossified and subcrescentic in form, its convex border forwards. It extends vertically from the parasphenoid below to the nasal above.

The *quadrate* has not yet assumed its fully adult form, the distal end of the orbital process being only cartilaginous and relatively shorter than in the adult.

The *columella* is represented only by its base, which is ossified; the stapedial rays are not distinguishable in the dried skull.

The *articulare* can still be distinguished as a separate element.

b. *Membrane-bones.*

The *parietal* externally is oblong in form, with its borders nearly straight and at right angles one with another. Immediately above the antero-ventral angle of its anterior border it is overlapped by a tongue-shaped process from the frontal. Its inferior border rests upon the dorsal border of the squamosal, than which it is a trifle broader. Its posterior or hinder border ventrad abuts against the epiotic, which at this point is cartilaginous, and dorsad forms a harmony suture with the supraoccipital. Internally the angle formed by its hinder and ventral borders is cut off from the inner surface of the skull by a portion of the pro- and epiotic bones.

The *frontal* has its hinder border nearly straight. Just above its postero-ventral angle it sends backwards a slight linguiform process to overlap the parietal. Its outer, ventral border caudad extends downwards to within a short distance of the level of the squamosal, cephalad it sends downwards a small orbital process to overlap the alisphenoid.

The *squamosal* seen externally is almost quadrate in form, but widest along its dorsal border, which, like the remaining three, is slightly hollowed. It articulates by a close harmony suture with the parietal. In the hollow of its hinder border there is a small osseous nodule representing a portion of the opisthotic.

The squamosal is almost entirely excluded from the cranial

cavity, being covered by the proötic. It appears, however, as a small semicircular tract of bone curving round the outer lateral border of the proötic, and bounded above by the frontal and in front by the alisphenoid.

The *nasal* extends backwards to a point corresponding in the adult with the level of the free posterior border of the anterior portion of the fenestrate interorbital septum. The external processes extend forwards to the anterior extremity of the external nasal fossa. The form of the nasal cleft is holorhinal. The posterior border of the nasal is produced backwards into a point. In the Grebe this point is separated from its fellow of the opposite side by a median forward extension of the frontal; in the Diver the two points meet in the middle line. The mesial edges of the right and left sides are separated one from another, for a considerable distance behind the level of the posterior narial aperture, by the nasal processes of the premaxilla. In the adult the extreme posterior limit of these processes is indicated by a more or less well-marked transverse groove, corresponding with the "nasal hinge" in forms in which this is present.

The *lachrymal* in the Grebes is subcrescentic in form, and apparently in process of degeneration. In the Divers it is still a moderately large bone. It articulates entirely with the nasal, from which it projects laterally, for a considerable distance on either side of the skull, in the form of a subcrescentic backwardly directed spur. The inner border of this spur is hollowed and forms the anterior limit of the supraorbital groove. The extreme posterior end of the spur anchyloses with the supraorbital ledge, which anteriorly between itself and the inner border of the lachrymal is deeply hollowed; thus a large supraorbital fenestra is left for the passage of the duct of the nasal gland. A similar supraorbital fenestra is found also in many Charadriiform birds, *e. g.* Alcidæ. The inferior limb of the lachrymal in the Divers extends downwards to within a short distance of the quadrato-jugal bar. Its free end is deeply notched, the lower projecting backwards for a considerable distance beyond the level of the upper limb of the notch.

The *premaxilla* in the Pygopodes is produced forwards into a point. The median cleft dividing the nasal processes does not extend so far forwards as in the Impennes. They rest upon the internal processes of the nasals.

The *maxilla* extends backwards rodwise to form the inferior border of the anterior half of the quadrato-jugal bar, underlying the jugal, and forwards as a long triangular splint below the maxillary process of the premaxilla. It is bounded on its inner side by the palatine. The maxillo-palatine process takes the form of a concavo-convex lamella, which in the Colymbi extends further backwards into the lachrymo-nasal fossa than in the Podicipides. There is never more than a vestige of the antrum of Highmore.

The *jugal* takes the usual elongated splint-like form. It overlies the maxilla anteriorly and the quadrato-jugal posteriorly.

The *quadrato-jugal* extends forwards beyond the middle of the quadrato-jugal bar, passing to the inner side both of the jugal and maxilla. It articulates posteriorly with the quadrate, fitting into a deep cup-shaped cavity.

The *vomer* in the Colymbi articulates with the hemipterygoid posteriorly, and with the palatine by means of its dorsal border.

In the Podicipides, in our Museum skeleton, the relations of the vomer to the hemipterygoid are not easily made out, owing to the fact that the hemipterygoid has not yet split off from the pterygoid (p. 1026).

The *palatine* is of great length, extending forwards as a long slender rod to within a short distance of the tip of the jaw. Posteriorly it is more or less grooved along its ventral aspect; from its inner dorsal border there arises caudad a leaf-like plate of bone turning inwards towards the middle line, the free border of which articulates with the superior border of the posterior end of the vomer.

The *pterygoid*, in so far as its general form is concerned, has been already described. We are concerned here only with the segmentation of its anterior end to form the

Hemipterygoid.—This can best be studied in the Colymbi. Here it bears a very close resemblance to that of the Impennes. In the skulls of two Divers in the Museum Collection the segmentation between the pterygoid and hemipterygoid is not only complete, but a perfect joint has formed between the two. The hemipterygoid itself has not yet fused with the palatine, but articulates with it by suture. Its form is that of a short triradiate spike extending forwards above the proximal end of the palatine, which underfloors it, to overlap the extreme posterior end of the vomer, which, as previously remarked, articulates for the most part with the palatine.

In the Grebe, in the youngest skulls, segmentation has not yet taken place; but at the point where this is about to happen there is an indication of a fracture, having jagged edges similar to that figured and described recently in the Impennes, only that in this case the separation is less distinct. In a nearly adult Grebe the form and relations of the hemipterygoid agree exactly with those of the Diver just described.

In the Tubinares, it will be remembered, the form of the hemipterygoid differed from that just described.

The *dentary* does not appear to undergo any appreciable change of form between nestling and adult periods.

The *splenial* is precisely similar in form, both in Grebes and Divers. It resembles a flattened cone, the base contributing to form the ventral border of the jaw.

The *coronoid* is at first rod-shaped, then turns abruptly upwards and expands into a flattened trowel-shaped blade, which remains more or less distinct throughout life.

The *angulare* is only just distinguishable as an independent bone.

The *supra-angulare* can be distinguished as a separate bone only in the youngest of the Grebes in the Museum Collection.

iv. The Vertebral Column.

The vertebræ seem to resemble those of the Steganopodes more nearly than of any other group, and, amongst the Steganopodes, they most nearly approach those of *Phalacrocorax*. They are quite different from those of the Impennes or Tubinares. They can, however, be at once distinguished from those of *Phalacrocorax*, in that the thoracic vertebræ are heterocœlous; but they differ also in other respects.

The *odontoid ligament* of the atlas is not ossified. The neural arches of the anterior cervicals are not, like those of the Impennes and Tubinares, deeply notched posteriorly. In the Colymbi they are sharply truncated and very broad, in the Podicipides they are, as in *Phalacrocorax*, marked by a slight notch; this notch, however, is cut out of the coalesced bases of a pair of hyperapophyses and lies *behind* the postzygapophyses; ordinarily such a notch is formed by cutting away the neural arch itself so as to leave the postzygapophyses as a pair of articular surfaces, each at the termination of a λ-shaped fork. The hyperapophyses of these vertebræ in the Divers take the form of stout pillars, grooved at the top. In the Grebes the pillars become mere tubercles placed close together and deeply grooved superiorly. In this they resemble the vertebræ in the same region of *Phalacrocorax*. The neural arches of the posterior cervicals do not present any very noticeable features.

In the Colymbi the 5th to the 10th vertebræ bear catapophyses, which, rapidly converging, give place to hypapophyses. These run backwards to the extreme end of the centrum in the form of a strong median keel. The vertebræ 1–4 and 11–13 bear catapophyses. In the Podicipides the cervical catapophyses from the 3rd to 13th vertebræ form deep tubular grooves for the carotids, recalling those of *Plotus* and *Phalacrocorax*. The cervicals 1–3 and 16–23 bear well-developed hypapophyses.

The thoracic vertebræ—and the last cervical—in the Divers are all free, save the last, which is anchylosed with the synsacrum. 1 to 5 bear median hypapophyses, with broadly expanded free ends, as in Alcidæ and some Impennes, e. g. *Pygoscelis*.

In the Grebes the last cervical and the thoracics 1–4 are anchylosed to form one mass; the 5th thoracic is free, but the 6th and 7th are fused with the synsacrum.

The synsacrum of the Pygopodes is remarkable for the extraordinary lateral compression which it has undergone, accompanied by an almost complete suppression of the di- and parapophysial elements. Pleurosteal elements appear to be wanting.

From the evidence obtainable from the synsacral region of a nestling Grebe we may perhaps be justified in holding that the synsacrum of the adult includes some 15 to 17 vertebræ. Of these the 1st is thoracic, the next 4 are lumbar, then follow 3 lumbo-sacral, 2 sacral, and 5 or 6 caudal. The 3rd and 4th lumbar bear small nipple-like parapophysial processes at the base of the neuron, behind these follow, as just stated, 3 lumbo-sacral and 2 sacral.

These last bear only a roughened diapophysial surface on the neuroid. There is no indication of a pleurapophysial element (sacral rib). If these two vertebræ are really sacral then they lie more caudad than usual, being behind the acetabulum and directly opposite the middle of the ilio-ischiadic foramen. The characteristic lumbar enlargement lies between the 2nd lumbar in front and the 1st sacral behind.

The free caudal vertebræ vary from 6–7 in number, including the pygostyle. They are very feebly developed in the Grebes. Intercentra occur below the caudal vertebræ both in Colymbi and Podicipides, but are reduced to mere vestiges in the former.

The lateral compression of the synsacrum is less marked in the nestling than in the adult; and the high neural crest of the adult preacetabular region is wanting in the nestling.

v. The Ribs.

The anterior anchylosed cervical ribs in the Pygopodes, in their form and position, recall those of *Phalacrocorax*. In the adult they are completely fused above with a downgrowth from the ventral surface of the anterior zygapophysis and below with the anterior and ventral borders of the catapophyses so as to form a bony canal for the vertebral artery.

In the Grebes they are found only from the 2nd to the 9th vertebræ, and are comparatively feeble, though long; those of the 2nd vertebræ are mere vestiges. In the Divers (Colymbi) they start from the 3rd vertebra, but terminate, as a pair of vestigial processes on the 10th or 11th; they differ markedly from those in the Grebes by their great length and thickness, extending backwards so as to embrace the catapophyses of the vertebra next behind, when the neck is straightened out.

The posterior free cervical ribs in the Podicipides are two in number (see next page). The penultimate, borne by the 21st vertebra, is long, styloid, and without an uncinate; that of the 22nd vertebra is longer, extending down to the level of the top of the sternal rib immediately behind it. It bears a large uncinate, but no sternal segment.

In the Colymbi there is only one free cervical, apparently corresponding to the antepenultimate rib of the Grebe.

The thoracic ribs in the Podicipides are 7 in number, the last two being overlapped by the ilium. 1–5, like the last cervical, bear large uncinates; these are absent on the 6th and 7th. There are 8 pairs of sternal ribs, the 8th being bound by membrane to the posterior border of the 7th. Thus there is evidence of the loss of at least one pair of thoracic ribs. It should be remarked, by the way, that the 7th pair of sternal ribs do not articulate with the sternum.

The thoracic ribs in the Colymbi number 8 pairs, all but the last of which articulate with the sternum. The last 3 pairs are overlapped by the preacetabular ilium. The 8th pair are mere vestiges.

It is probable that the long styloid free rib of the last cervical or cervico-thoracic vertebra was originally larger and connected with the sternum by means of a sternal rib; in other words, this represents a thoracic vertebra which has been transferred to the cervical series by the loss of the sternal segments and its ribs. Thus, what is now the first was earlier the second thoracic vertebra and rib.

In the Podicipides this transference of vertebra from the thoracic to the cervical series is still more marked, inasmuch as what now forms the first thoracic vertebra and rib in the Diver is in the Grebe the last cervical. This seems the most satisfactory way of explaining the presence of the long free ribs in both Diver and Grebe, and wherever else they occur. The transference of the 2nd pair in the Grebe seems to have been comparatively recent, inasmuch as the uncinate is still retained.

If this interpretation be correct, and it is one which was, I believe, originally put forward by the late Prof. T. J. Parker, then one more thoracic segment is represented in the Grebe than in the Diver, inasmuch as what now answers to the 1st thoracic of the Grebe really represents the 3rd, and what now answers to the 6th—the last vertebra now connected with the sternum by a sternal rib—represents the 8th thoracic vertebra. The 6th and 7th vertebræ have already fused with the synsacrum. The 7th (=9th) ceases to be connected with the sternum, and the rib of the 8th (=10th) vertebra is represented only by its sternal segment. In the Diver there is only evidence for 9 thoracic vertebræ, the 9th now venturing but a minute stylet partly fused with the preacetabular ilium, and projecting from its ventral border as a small spine.

The presence of these free ribs is exceedingly interesting, they form one of the many links in the chain of evidence, hinted at by Mr. Beddard (1), which goes to show that a shortening of the sternum has taken place.

The ribs and uncinate in both Grebes and Divers are relatively broad and flat and of moderate length. In all these particulars they differ markedly from the Alcidæ, to which the Pygopodes bear a superficial resemblance. In this last group the sternal and thoracic ribs are of great length. Especially is this the case with the hindmost ribs, which are of enormous length, extending backwards so as to project beyond the level of the free end of the pubes.

vi. The Sternum and Pectoral Girdle.

The *sternum* of the Colymbi is very long and bears a superficial resemblance to that of some Alcidæ. It can be immediately distinguished therefrom amongst other things by the shallower carina, the feebly developed spina externa, and the large linguiform metasternum, which projects considerably beyond the posterior lateral processes.

The sternum of the Podicipides differs very markedly from that of the Colymbi. In the first place, it is conspicuously shorter. In

Podicipes fluviatilis, for instance, the width across the posterior lateral processes may equal the whole length of the corpus sterni; in other words, the sternum may be as broad as long. In the Divers the width across the widest part is about one-third the total length of the sternum. There is no spina externa nor interna; instead, this region of the sternum is deeply hollowed. The lower lip of the coracoid groove is very large, making the groove exceedingly deep. In the Diver this lip is not greatly developed. The metasternum is deeply notched and not produced backwards into a linguiform plate as in the Divers. The anterior lateral processes are larger and project forward. In the Diver they are sharply truncated, the free anterior border sloping distinctly backwards.

The *coracoid* is short and straight, both in Grebes and Divers. In the former, the epicoracoid is marked by a wide articular surface running transversely across its ventral aspect. The procoracoid process is absent. In the latter the broad articular surface is absent on the ventral aspect and there is a small procoracoid process. In both there is a well-marked *processus lateralis*. There is no supracoracoid foramen, as in the Alcidæ; the posterior free border of the epicoracoid is almost knife-like and not, as in the Alcidæ, squarely truncate.

The *scapula*, as compared with that of the Alcidæ, is relatively short, and has but a very narrow transverse articular surface, instead of a very wide one as in Alcidæ. In the Podicipides there is a well-marked acromion process projecting downwards from the shaft beyond the level of the coracoid articular surface.

The *clavicle* is not provided with an external lateral facet for articulation with the coracoid, as in many Steganopodes and Alcidæ. There is a small hypocleideum. The right and left limbs of the clavicle are very broad and laterally compressed in the Divers. In the Grebes the upper free end of each limb is pointed, and runs along the antero-internal border of the scapula.

vii. The Pelvic Girdle.

The form of the pelvic girdle in the Pygopodes is unique amongst living birds. Its most characteristic feature is the extraordinary elongation and lateral compression which has taken place. Although the synsacrum has been involved in this compression, it is not, at first sight, so marked as in the innominate bones. The preacetabular ilium is small and narrow, and widely separated from its fellow of the opposite side, but is not otherwise very remarkable. The postacetabular ilium, however, takes the form of a broad, flat, almost or quite vertical lamina. This in the Grebe meets its fellow of the opposite side, in the Diver is separated by the knife-like ridge formed by the neural spines of the anchylosed synsacral vertebræ. The ilio-ischiadic foramen is moderately large; the obturator foramen in the Colymbi remains permanently in connection with the fissure of that name, in the Podicipides the

foramen is shut off from the fissure by a bar of bone. The pubis is long and rod-shaped throughout in the Podicipides, but becomes spatulate at its free end in the Colymbi. There is no pectineal process.

The preacetabular ilium, the ischium, and pubis become more or less completely ossified at a much earlier date than the post-acetabular ilium. This last is as yet for the most part still cartilaginous. The separate elements of the innominate bones are still very distinct.

viii. The Pectoral Limb.

The wings of the Grebe and Diver bear a very close similarity, and perhaps more nearly resemble those of *Phalacrocorax* than of any other group.

The wing of the Diver can be readily distinguished from that of the Grebe by the great relative length of the metacarpals. As Shufeldt (18) has pointed out, the Divers in this particular probably stand alone. The delto-pectoral crest is larger in the Diver, and the fossa for the brachialis internus is deeper. There is no ectepicondylar process nor subtrochanteric pneumatic fossa. The delto-pectoral crest in the Divers is separated from the crista inferior by a deep gorge—the *planum intertuberculare*; this in the Grebe is represented only by a shallow depression. The coraco-humeral groove takes the form of a deep pit ventrad and distad of the caput humeri.

The *forearm* in the Grebe is nearly as long as the arm, considerably less so in the Divers.

In the *manus* the great length of the metacarpals in the Colymbi has already been commented on; the 1st phalanx of digit II. in the Divers is relatively shorter and broader than in the Grebes; the same applies to the remaining phalanges.

The carpus does not seem to call for any special remark. For further details concerning the fore limb, see Key (p. 1044).

ix. The Pelvic Limb.

The pelvic limbs of the Grebe and Diver bear an exceedingly close resemblance one to another, but differ in almost every particular from those of any other group.

The *femur* is very short and thick, with a strong dorsal curve. Its proximal and distal extremities are greatly elongated transversely. The head lies rather below the level of the antetrochanter, and bears a deep fossa for the ligamentum teres. The fibular condyle is of great size, and lies considerably below the level of the tibial.

The *tibio-tarsus* is remarkable for the enormous development of the cnemial crests, which form a large pyramidal process projecting vertically upwards beyond the femoral articular surface. This

process in the Diver (fig. 1) may exceed the femur in length. In the Grebes (fig. 2) it is not more than half as long. The ecto-

Fig. 1.

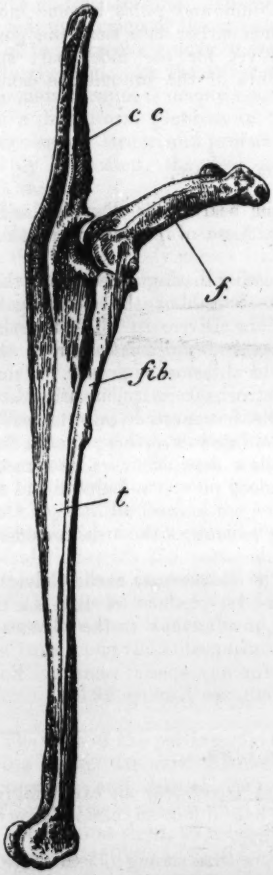
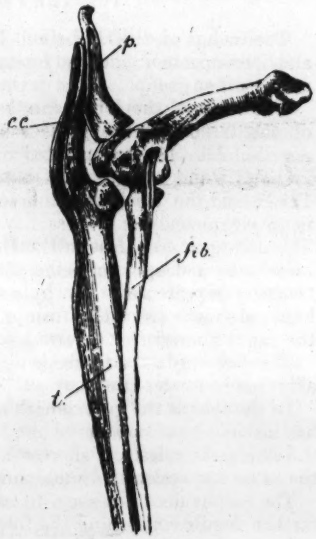


Fig. 2.



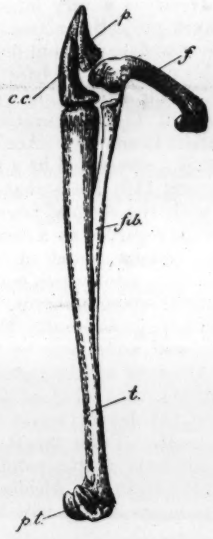
Outer aspect of the pelvic limb of *Colymbus septentrionalis* (fig. 1) and *Podicipes cristatus* (fig. 2), adult.

c c, cnemial crest; *p.*, patella; *f.*, femur; *fib.*, fibula; *t.*, tarsus.

and entocnemial crests bear about equal shares in the formation of this cnemial process.

The Tubinares and Alcidæ both develop large cnemial processes, which, as in the Pygopodes, project vertically beyond the femoral articular surface. But these never attain the size of those of the Pygopodes, and differ, moreover, in form. In the Alcidæ the ento- and ectocnemial crests bear about equal shares in the formation of the process, but the former starts suddenly from the shaft just below the head of the tibia, in the Pygopodes it arises near the middle of the shaft and more or less gradually increases in size, and in the Tubinares it arises as in Alcidæ, but immediately expands into a more or less flabelliform plate.

Fig. 3.



Outer aspect of the pelvic limb of *Podicipes cristatus*, nestling.

p.t., proximal tarsal mass; other letters as in figs. 1 & 2.

About the exact homology of the great cnemial crest of the Pygopodes there seems to be some doubt, even now.

According to Shufeldt (**18**) it is to be regarded as representing the olecranon of the ulna, and both are to be treated "as mere extensions of the shaft of the bones" to which they belong. The cnemial crest, or "rotular process," is stated by him to have a separate centre of ossification, separate from that of the tibial epiphysis. The patella, which has been held by

Vicq-d'Azyr (**20**), Owen (**13**), and others to be the homologue of the olecranon, is considered by Shufeldt as a sesamoid only.

Prof. D'Arcy Thompson (**19**) sees, apparently, like Selenka (**15**) and Flourens, in the cnemial crest of the Grebes and Divers nothing more than "the upper extremity of the tibia."

In a preparation in our Museum Collection, of the pelvic limb of a nestling Grebe, the cnemial crest forms a part of the tibial epiphysis in which a centre of ossification is just making its appearance (fig. 3, p. 1039). From this it would appear that the process in question is really only a greatly elongated epiphysis.

The *fibula* in the Colymbi extends downwards to the level of the superior border of the extensor bridge; it terminates in the Podicipides near the distal $\frac{1}{3}$ of the tibio-tarsus.

The *patella* in the Grebe is a very large, laterally compressed pyramidal bone, the apex projecting above the level of the cnemial process, whilst its inner surface is more or less closely applied to the outer border of this process. Its base forms a longitudinally elongated glenoid surface for articulation with the femur.

In all the skeletons of Colymbi in the Museum Collection, unfortunately, the patella is missing. According to Shufeldt (**18**) and others it is, however, represented by a small flake-like bone.

Prof. D'Arcy Thompson (**19**) holds that the patella proper of the Divers has fused with the cnemial process, and that the small patelliform plate is to be regarded as a sesamoid, and *not* as the homologue of the free patella found in *Podicipes*, *Hesperornis*, and other forms. This is a point which could probably be settled by an examination of nestlings or embryos.

Amongst the Alcidæ, e. g. *Uria alle*, the patella is more or less quadrate in form, and articulates by the lower half of its anterior surface with the apex of the cnemial process, this being very much less developed than that of the Grebe and Diver. Thus, the upper half of this border serves as a further extension dorsad of the process itself. From this it will be remarked that the position, size, and form of the patella, and the development of the cnemial process, in the Alcidæ is distinctly different from that of the Colymbi, as also, it will be remembered, is the form of the pelvis.

In all these particulars it will be noticed that, though there is a tendency in the Alcidæ to modification along the same lines,—to a convergence of characters, due to similar methods of progression, resulting in a similar upright carriage when on land,—the Alcidæ are less specialized than the Colymbidæ, which possibly had its origin in that of the stock of the Cretaceous *Hesperornis*. The pelvic girdle and limb, in common with the rest of the skeleton, of this bird, are, as is well-known, almost indistinguishable from those of the modern Colymbi. Indeed, when we eliminate the presence of teeth, the Ratite sternum, vestigial wing, and complete ilio-ischiadic fissure, the only points of difference appear to be such as serve to distinguish species one from another.

The form of the patella and cnemial process of the Alcidæ more nearly resembles that of the Impennes, as does, to a lesser extent, the pelvis.

The form of the *tarso-metatarsus* in the Grebes and Divers is very similar. That of the Grebe may be distinguished from the Diver by the larger size of the intercotylar tubercle and the great depth of the inner glenoid surface for the inner tibio-tarsal condyle. In both groups the tarso-metatarsus is much compressed laterally, and the ectotrochlea is much reduced. The hypotarsus is simple. Other characters will be found in the Key (p. 1044).

The phalanges of the toes are much flattened dorso-ventrally, the ungual phalanx especially so. The 4th digit is longer than the 3rd.

x. Summary.

The present paper affords good evidence in favour of the views of Beddard, Fürbringer, Gadow, and others who hold that the Grebes and Divers are closely related, but refuse to associate them with the Auks and Gulls as was done by Huxley and others.

The Pygopodes (=the Colymbi of Beddard) seem to be nearly related to the Tubinares, the Impennes, and the Steganopodes; but, as Mr. Beddard remarks, "any comparisons bristle with difficulties."

That *Hesperornis* rightly belongs to this sub-order there can no longer be any doubt, after Prof. D'Arcy Thompson's admirable memoir; there is one point which has apparently escaped the notice of this writer, however, with regard to the pelvic girdle of *Hesperornis*. This differs from that of both Grebe and Diver, in that the pre- and postacetabular ilium form one great, vertical and laterally compressed blade of very considerable depth. In the Grebe and Diver the preacetabular ilium takes the form of a narrow blade, twisted so as to lie in an obliquely horizontal position. Furthermore, *Hesperornis* seems to be peculiar in that the innominate bones meet throughout in the mid-dorsal line, above the neural crest of the synsacrum; in this particular, however, it approaches the Grebes, where the postacetabular ilium behaves in this way; similarly it agrees with the Grebes in the shortening of the sternum and the large size of the patella. These last two points, however, must be regarded as coincidences rather than indications of affinity; that is to say, *Hesperornis* must not on account of these points be regarded as more closely allied to the Grebes than to the Divers. Indeed, its sternum differs materially from that of both these families in that it was keelless, whilst the patella differs from that of the Grebe in being pierced by a foramen for the ambiens. But these and other points will be found exhaustively discussed in the memoirs of Marsh and D'Arcy Thompson.

Mr. Beddard regards the Grebes and Divers as representing two

families; Dr. Gadow would regard these as of subordinal value. Which of the two views will become ultimately adopted remains to be seen. Probably the first is a sufficiently wide separation.

Finally,—and it had almost escaped mention,—the skeleton of the Pygopodes is non-pneumatic.

xi. Key to the Osteology of the Pygopodes.

A. Skull. (Plate LXXII.)

Holorhinal and schizognathous; nares pervious; vomer cleft posteriorly; basipterygoid processes absent; lachrymal small, feebly developed, not extending downwards to join the quadrato-jugal bar; quadrate with an elongate orbital process; maxillo-palatine processes in the form of horizontal laminæ, never extending as far backwards as the scroll-like antero-internal border of the palatine; basitemporal plate of the parasphenoid with an inflated anterior border converting the Eustachian grooves into tubes, with a median aperture below the parasphenoidal rostrum; temporal fossæ more or less well developed. Dentary suture of mandible tending to disappear in the adult. Angulare truncated.

A. Supraorbital grooves very deep, with a well-developed ledge; temporal fossæ wide, separated one from another superiorly by a median sagittal ridge; lachrymal more or less completely fused with the nasal; vomer grooved and laterally expanded dorsally; with a deep median, ventral keel, and with a strongly marked ventral keel in front of the parasphenoidal rostrum; Eustachian grooves never completely closed; large postorbital and paroccipital processes ..... Colymbidæ.
(Only one genus—*Colymbus*.)

B. Supraorbital grooves feebly developed or absent; lachrymal free, not projecting posteriorly from the sides of the supraorbital margin; vomer blade-shaped; Eustachian grooves completely closed; postorbital and paroccipital processes obsolete ..... Podicipedidæ.

Key to the Genera of the Family Podicipedidæ[1].

A. Without a broad bifid, overhanging postorbital process.

Group *a*. (Type *P. cristatus*.) With a wide and distinct temporal fossa, and strongly marked cerebral prominence; postorbital region of the frontal marked by a deep scar, for the temporalis muscle, the superior border of which has a rough edge; upper jaw longer than cranium.

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[1] I do not feel justified in attempting to form "Keys" to the species, either for the skull or any other part of the skeleton, of the forms comprising the two sub-families dealt with in this paper. Inasmuch as of the Colymbidæ I have only two species, *C. glacialis* and *C. septentrionalis*, and these are easily recognizable by the difference in size alone. In the Podicipedidæ I have only 8 out of a possible 19 species of the genus *Podicipes*; only one skeleton of *Æchmophorus*, and no bones whatever of *Podylimbus*. From what I can gather from our material, the difference between the three genera recognized in the British Museum Catalogue vol. xxvi. is very slight, and that between the species comprising these genera is even less. The genus *Podicipes* seems to divide itself into two groups—one of the type of *P. fluviatilis*, and one of the type of *P. cristatus*. The differences upon which such separation rests concern the skull only, and depend mainly upon size; the smaller species having a relatively shorter and wider skull, and ill-defined temporal fossæ.

Group *b*. (Type *P. fluviatilis*.) Temporal fossa ill-defined; cerebral prominence small; fossa for insertion of temporalis muscle not deeply excavated on postorbital region of frontals; with a small postorbital process; upper jaw not longer than cranium.

Podicipes.

B. With a broad bifid, overhanging postorbital process..... *Æchmophorus.*

B. Vertebræ.

Emargination of neural arches of cervical vertebræ caudad, slight, never extending forward beyond the level of the postzygapophyses; anterior cervical ribs of great length; all cervicals save atlas and axis with a bony vertebrarterial canal closed externally by the cervical ribs; synsacrum elongated, and laterally compressed, so as to be almost styliform.

A. Neural spines of anterior cervicals in form of long median ridge; hyperapophyses of anterior cervicals widely separated; neural arch of 2nd, 3rd, and 4th with a rounded free posterior border. All thoracic vertebræ free, the 1st–3rd with long ⊥-shaped hypapophyses; 6 free caudals, excluding the pygostyle; pygostyle broad and strong ..... Colymbidæ.

B. Neural spines of anterior cervicals almost obsolete; catapophyses of anterior cervicals meeting in the middle line; last cervico-thoracic and thoracic 1–4 anchylosed; free end of hypapophyses scarcely, if at all, laterally expanded; 7 free caudals, excluding pygostyle; pygostyle feeble.

Podicipedidæ.

It is almost impossible to distinguish, in the synsacrum, lumbar, lumbosacral, and sacral vertebræ. The lumbar region has apparently undergone a great shortening. There are no vertebræ which can be distinguished—in the dried skeleton—as sacral. The postsynsacral region—that lying behind the acetabulum—is of great length.

The vertebral formula must therefore stand as follows:—

Syn. sc.

Cv. 13. Cv. th. 1. Th. 6+2. L. Lb. sc. Sc. ? 5. Cd. 10+7=44.

8 17

Colymbidæ.

Syn. sc.

Cv. 20. Cv. th. 2. Th. 6+1. L. 4. Lb. sc. 3. Sc. 2. Cd. 6+7=51.

7 13

Podicipedidæ.

C. Sternum and Pectoral Girdle.

Corpus sterni with a pair of notches posteriorly; coracoid grooves deep; metasternum either notched posteriorly, or broadly linguiform, and projecting far beyond posterior lateral processes; anterior lateral processes not projecting forwards beyond the level of the coracoid grooves; no supracoracoid foramen; clavicle not articulating by a glenoid surface with acromion of scapula.

A. Greatest width of sternum across anterior lateral processes rather less than ½ the length; coracoid groove moderately deep; spina externa sessile and bifid; keel very shallow; metasternum linguiform, projecting far beyond level of posterior lateral processes; precoracoid very small; posterior lateral processes of coracoid large and spinose ..... Colymbidæ.

B. Greatest width of sternum across posterior lateral processes more than ⅓—sometimes equal to—its whole length; metasternum deeply notched, not projecting so far back as ends of posterior lateral processes; coracoid groove very deep; no *spina externa* or *interna*; no precoracoid; posterior lateral processes of coracoid short and blunt; scapula with long acromion. PODICIPEDIDÆ.

D. PELVIC GIRDLE.

Greatly elongated and compressed laterally behind the acetabulum; closely resembles that of the Cretaceous *Hesperornis*, and differs entirely from that of any other living Carinate bird, the postacetabular ilium being represented by a nearly vertical plate of bone; synsacrum almost styliform; pleurostea caudad of acetabulum wanting; parapophyses vestigial.

A. Free end of pubes spatulate ..... COLYMBIDÆ.

B. Free end of pubes not spatulate ..... PODICIPEDIDÆ.

E. PECTORAL LIMB.

The bones of the wing are relatively long; the humerus has a moderately well-developed delto-pectoral crest, the coraco-humeral groove takes the form of a deep pit; there is a shallow fossa for the *brachialis internus*; the *fossa subtrochantericus* is blind. The forearm is nearly or quite as long as the arm. Mc. III. is long, slender, and runs parallel with Mc. II.

A. Carpo-metacarpus much elongated; Mc. I. very long, ½ as long as Mc. II.; manus as long as forearm ..... COLYMBIDÆ.

B. Carpo-metacarpus not greatly elongated; Mc. I. very short; manus shorter than forearm..... PODICIPEDIDÆ.

F. PELVIC LIMB. (Figs. 1–3, pp. 1038–9.)

Femur very short; tibio-tarsus with an enormous cnemial crest; tarso-metatarsus laterally compressed; outer toe longest; ungual phalanges much flattened.

A. Cnemial crest as long as or longer than femur; fibula extending downwards to the tarsus, or very nearly so; the ecto-trochlear foramen of tarso-metatarsus tubular; hypotarsus simple ..... COLYMBIDÆ.

B. Cnemial crest shorter than femur; fibula terminating near the lower ⅓ of the leg; hypotarsus simple; *ectotrochlear foramen* in the form of a groove..... PODICIPEDIDÆ.

xii. LIST OF WORKS REFERRED TO OR CONSULTED.

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EXPLANATION OF PLATE LXXII.

als.=alisphenoid.
bt.=basitemporal platform.
b.oc.=basioccipital.
b.s.=basisphenoid.
b.sr.=parasphenoidal rostrum.
c.=occipital condyle.
c.p.=cerebellar prominence.
c.r.=coronal ridge.
d.=dentary.
ep.o.=epiotic.
ex.o.=exoccipital.
f.f.=floccular fossa.
fr.=frontal.
h.pt.=hemipterygoid.
l.f.=lachrymal foramen.
me.=meatus internus.
mes.=mesethmoid.
n.=nasal.
n.pmx.=nasal process of premaxilla.
op.o.=opisthotic.
p.=parietal.
pa.=palatine.

pro.=proötic.
pt.=pterygoid.
q.=quadrate.
s.a.=supra-angular.
s.c.=sagittal crest.
s.o.=supraoccipital.
so.g.=supraorbital groove.
so.l.=supraorbital ledge.
sq.=squamosal.
sq.p.=squamosal prominence.
sq.pw.=squamoso-parietal wing.
t.f.=temporal fossa.
tr.f.=trigeminal foramen.
v.=vomer.

Fig. 1. Dorsal aspect of the skull of *Podicipes cristatus* (p. 1020), to show the well-developed sagittal crest, temporal fossæ, coronal ridge, squamoso-parietal rings, the free lachrymal, and the feeble supraorbital grooves.

Fig. 2. Dorsal aspect of the skull of *Colymbus septentrionalis* (p. 1020), to contrast with fig. 1, with the great development of the supraorbital grooves and ridges and the lachrymal fontanelle.

Fig. 3. Lateral aspect of fig. 2 (p. 1021), showing the conspicuous cerebellar prominence, temporal fossa, and supraorbital ledge.

Fig. 4. Lateral aspect of the skull of a nestling *Podicipes cristatus*, outer view (p. 1030), to show the unclosed sutures.

Fig. 5. Lateral aspect of the skull of a nestling *Podicipes cristatus*, inner view, to show the unclosed sutures.

Fig. 6. Ventral view of skull of an adult *Colymbus septentrionalis* (p. 1026), to show the schizognathous palate.

Fig. 7. Lateral aspect of a portion of the pterygoid and palatine of *Colymbus glacialis* (p. 1032), to show the hemipterygoid.

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APPENDIX.

LIST OF ADDITIONS TO THE SOCIETY'S MENAGERIE

DURING THE YEAR

1899.

Jan. 1. 3 Grey Squirrels (*Sciurus cinereus*). Deposited.
3. 1 Delalande's Gecko (*Tarentola delalandii*). Presented by Mr. Percy Leach.
1 Delalande's Gecko (*Tarentola delalandii*). Presented by H. Munt, Esq., F.Z.S.
4. 3 Nose-crested Iguanas (*Iguana tuberculata rhinolophus*). Deposited.
1 Spiny-tailed Iguana (*Ctenosaura acanthura*). Deposited.
1 Leopard (black variety) (*Felis pardus*). Purchased.
5. 1 Huanaco (*Lama huanucos*), ♂. Presented by Henry F. Fox, Esq.
3 Brazilian Caracaras (*Polyborus brasiliensis*). Purchased.
7. 1 Crossbill (*Loxia curvirostra*). Presented by H. O. Blanford, Esq.
2 Warty-faced Honey-eaters (*Xanthomyza phrygia*). Purchased.
8. 2 Dorsal Squirrels (*Sciurus hypopyrrhus*). Deposited.
9. 1 White-cheeked Hill-Partridge (*Arboricola atrigularis*). Presented by H. T. Cassells, Esq.
6 Puff-Adders (*Bitis arietans*). Born in the Menagerie.
10. 1 Regent-bird (*Sericulus melinus*). Deposited.
1 Common Weka-Rail (*Ocydromus australis*). Deposited.
3 Australian Rails (*Rallus pectoralis*). Deposited.
2 White-cheeked Honey-eaters (*Meliphaga sericea*). Purchased.
1 Lunulated Honey-eater (*Melithreptus lunulatus*). Purchased.
1 Red Ground-Dove (*Geotrygon montana*). Purchased.
11. 2 Gluttons (*Gulo luscus*), ♂ ♀. Purchased.
12. 1 Gazelle (*Gazella dorcas*), ♀. Presented by J. L. N. Allison, Esq.
1 Common Otter (*Lutra vulgaris*), ♀. Purchased
13. 1 Black-headed Lemur (*Lemur brunneus*). Deposited.
16. 1 Grey Lemur (*Hapalemur griseus*). Deposited.

Jan. 17. 1 Nankeen Night-Heron (*Nycticorax caledonicus*). Presented by John Brinsmead, Esq., F.Z.S.
4 Ruddy-headed Geese (*Chloëphaga rubidiceps*), 2 ♂, 2 ♀. Purchased.
18. 1 Argali Sheep (*Ovis ammon*), ♂. From the Altai Mountains. Purchased. See P. Z. S. 1899, p. 64.
1 Black-backed Jackal (*Canis mesomelas*). Presented by Mrs. J. E. Matcham.
2 Diamond Pythons (*Python spilotes*). Presented by S. A. Michels, Esq.
19. 1 Patas Monkey (*Cercopithecus patas*), ♂. Presented by C. H. Wimpress, Esq.
20. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mr. P. de Loriol.
1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mr. P. de Loriol.
21. 2 Arabian Baboons (*Cynocephalus hamadryas*), ♂ ♀. From Aden. Presented by Dr. H. O. Forbes, F.Z.S., & W. R. Ogilvie Grant, Esq.
23. 2 Barnard's Parrakeets (*Platycercus barnardi*). Received in exchange.
24. 1 Tui Parrakeet (*Brotogerys tui*). Purchased.
1 Black-headed Lemur (*Lemur brunneus*), ♂. Deposited.
25. 1 Chimpanzee (*Anthropopithecus troglodytes*), ♀. Presented by Miss K. M. Burne.
26. 1 Green Monkey (*Cercopithecus callitrichus*), ♂. Presented by Mr. F. W. Coker.
3 Common Crowned Pigeons (*Goura coronata*). Purchased.
27. 1 Two-spotted Paradoxure (*Nandinia binotata*). Presented by Miss A. M. Deeks.
28. 1 Uvæan Parrakeet (*Nymphicus uvæensis*). Purchased.
30. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mrs. Emily Price.
1 Vulpine Phalanger (*Trichosurus vulpecula*), ♀. Presented by W. J. Matthews, Esq.
31. 1 Bonnet-Monkey (*Macacus sinicus*), ♂. Presented by Miss May Wieland.
1 Red-throated Diver (*Colymbus septentrionalis*). From Holland. Purchased.

Feb. 1. 1 Red Kangaroo (*Macropus rufus*), ♂. Born in the Menagerie.
2. 3 Common Marmosets (*Hapale jacchus*). Deposited.
1 Sooty Mangabey (*Cercocebus fuliginosus*), ♂. Presented by Mr. B. Stewart.
1 Great Kangaroo (*Macropus giganteus*), ♀. Deposited.
1 Great Wallaroo (*Macropus robustus*), ♀. Deposited.
1 Agouti (*Dasyprocta* sp. inc.). Deposited.
3. 5 Puff-Adders (*Bitis arietans*). Born in the Menagerie.
4. 2 Indian Chevrotains (*Tragulus meminna*). Purchased.
5 Sacred Kingfishers (*Halcyon sancta*). Purchased.
4 Lace Monitors (*Varanus varius*). Purchased.
1 Black Spider-Monkey (*Ateles ater*). Presented by Capt. Charles T. Swain.
7. 1 Guinea Baboon (*Cynocephalus sphinx*), ♀. Presented by Mrs. Mellin.
1 Bennett's Wallaby (*Macropus bennetti*). Deposited.

Feb. 8. 2 Black-necked Lizards (*Agama atricollis*). Presented by W. Champion, Esq., F.Z.S.

9. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Hamilton Baker, Esq.
1 Australian Cassowary (*Casuarius australis*). Deposited. See P. Z. S. 1899, p. 291.
1 Two-wattled Cassowary (*Casuarius bicarunculatus*). Deposited. See P. Z. S. 1899, p. 291.
1 Bennett's Cassowary (*Casuarius bennetti*). Deposited. See P. Z. S. 1899, p. 291.
4 Bearded Titmice (*Panurus biarmicus*), 2 ♂, 2 ♀. Purchased.
2 Long-tailed Grass-Finches (*Poëphila acuticauda*), ♂ ♀. Purchased.
1 Woodcock (*Scolopax rusticula*). Presented by Capt. Bewicke.

10. 1 Brush-tailed Kangaroo (*Petrogale penicillata*), ♀. Purchased.

11. 1 Hobby (*Falco subbuteo*). Purchased.
1 Blue-crowned Parrakeet (*Tanygnathus luzonensis*). Purchased.
2 Night-Herons (*Nycticorax griseus*). Presented by Mr. Chas. Humberset.

13. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mrs. A. J. Pauley.

14. 3 Reeves's Terrapins (*Damonia reevesi*). Deposited.
3 Black-headed Terrapins (*Damonia reevesi unicolor*). Deposited.

15. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by J. H. Howden, Esq., F.Z.S.
2 Red-breasted Mergansers (*Mergus serrator*), ♂ ♀. Purchased.

16. 1 Restless Cavy (*Cavia porcellus*). Presented by Miss Druce.
1 Mozambique Monkey (*Cercopithecus pygerythrus*), ♂. Presented by E. Tudor Johnson, Esq.
2 Mountain Ka-Kas (*Nestor notabilis*). Presented by the Hon. Walter Rothschild, M.P., F.Z.S.
2 Bahama Ducks (*Pœcilonetta bahamensis*,) ♂ ♀. Purchased.
9 Spotted-billed Ducks (*Anas pœcilorhyncha*), 3 ♂, 6 ♀. Purchased.
1 Bar-headed Goose (*Anser indicus*). Purchased.
1 Coypu (*Myopotamus coypus*). Presented by Sidney Grey, Esq.

17. 1 Beccari's Cassowary (*Casuarius beccarii*). Deposited.
1 Salvadori's Cassowary (*Casuarius salvadorii*). Deposited.
2 Mauve-necked Cassowaries (*Casuarius violicollis*). Deposited.
2 Yellow-naped Cassowaries (*Casuarius occipitalis*). Deposited.
1 Milne-Edwards's Casssowary (*Casuarius edwardsi*). Deposited.
} See P. Z. S. 1899, p. 291.
1 Alexandrine Parrakeet (*Palæornis alexandri*), ♀. Presented by A. Pam, Esq., F.Z.S.

18. 1 Canadian Lynx (*Felis canadensis*). Presented by Henry Anger, Esq., F.Z.S.
1 Prairie-Wolf (*Canis latrans*). Presented by Henry Anger, Esq., F.Z.S.
5 Brent Geese (*Bernicla brenta*). Purchased.

Feb. 20. 1 Rough-legged Buzzard (*Archibuteo lagopus*). Presented by the Hon. Walter Rothschild, M.P., F.Z.S.
1 Virginian Eagle-Owl (*Bubo virginianus*). Presented by the Hon. Walter Rothschild, M.P., F.Z.S.
1 Great Eagle-Owl (*Bubo maximus*). Deposited.
21. 2 Common Herons (*Ardea cinerea*). Presented by F. J. Bridgman, Esq.
22. 1 Common Paradoxure (*Paradoxurus niger*). Presented by W. O. Sheppard, Esq.
23. 2 Yellow Conures (*Conurus solstitialis*). Purchased.
1 Pale-headed Parrakeet (*Platycercus pallidiceps*). Presented by W. F. Clayton, Esq.
1 Rose-Hill Parrakeet (*Platycercus eximius*). Presented by W. F. Clayton, Esq.
1 Cockateel (*Calopsittacus novæ-hollandiæ*), ♂. Presented by Mr. Edward Hawkins.
24. 1 Cambayan Turtle-Dove (*Turtur senegalensis*). Presented by D. Seth-Smith, Esq., F.Z.S.
2 Black-backed Piping-Crows (*Gymnorhina tibicen*). Deposited.
4 Laughing Kingfishers (*Dacelo gigantea*). Deposited.
2 Black Swans (*Cygnus atratus*). Deposited.
25. 1 Long-tailed Marmot (*Arctomys caudatus*). From Gilghit. Presented by Capt. A. H. McMahon, F.Z.S.
26. 1 Brazilian Tortoise (*Testudo tabulata*). Presented by John Gordon, Esq.
27. 1 Smooth-headed Capuchin (*Cebus monachus*), ♂. Presented by Mrs. Cecil Popham.
1 Great Kangaroo (*Macropus giganteus*), ♀. Purchased.
28. 2 Thars (*Hemitragus jemlaicus*), ♂ ♀. Purchased.

Mar. 1. 3 Elliot's Pheasants (*Phasianus ellioti*), 1♂, 2♀. Purchased.
1 Sooty Mangabey (*Cercocebus fuliginosus*), ♀. Presented by B. Horsburgh, Esq., Lieut. A.S.C.
2. 1 White-eyebrowed Guan (*Penelope superciliaris*). Purchased.
1 Little Guan (*Ortalis motmot*). Purchased.
1 Thick-tailed Opossum (*Didelphys crassicaudata*), ♀. Purchased.
1 Black-backed Jackal (*Canis mesomelas*). Presented by R. C. Cooper, Esq.
3. 1 Silver Pheasant (*Euplocamus nycthemerus*), ♂. Presented by W. McNaughton Love, Esq.
1 Long-billed Butcher-Crow (*Cracticus destructor*). Deposited.
1 Laughing Kingfisher (*Dacelo gigantea*). Deposited.
5. 1 Wild Cat (*Felis catus*), ♂. Deposited.
6. 1 Echidna (*Echidna hystrix*). Deposited.
1 West-African Love-bird (*Agapornis pullaria*). Presented by Mr. C. W. Gameys.
5 Crested Colins (*Eupsychortyx cristatus*). Purchased.
7. 1 Common Seal (*Phoca vitulina*). Presented by H.G. the Duke of Richmond & Gordon, K.G.
9. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Mr. W. White.
1 Common Seal (*Phoca vitulina*). Presented by Gambier Bolton, Esq.
1 Rose-crested Cockatoo (*Cacatua moluccensis*). Deposited.
10. 1 Common Hare (*Lepus europæus*). Presented by Miss Henrietta Holland.

Mar. 10. 1 Egyptian Jerboa (*Dipus ægyptius*). Presented by F. Tomlin, Esq.
1 Cabot's Tragopan (*Ceriornis caboti*), ♀. Purchased.
11. 1 Kiang (*Equus hemionus*), ♀. Purchased. See P. Z. S. 1899, p. 427.
2 Great Bats (*Vespertilio noctula*). Presented by Mr. E. Hilton.
13. 1 Indian Eryx (*Eryx johni*). Purchased.
4 Waxwings (*Ampelis garrulus*). Purchased.
3 Wandering Tree-Ducks (*Dendrocygna arcuata*). Purchased.
1 Reed-Bunting (*Emberiza schœniclus*). Presented by Mr. F. Chatwin.
1 Adorned Terrapin (*Chrysemys ornata*). Purchased.
14. 2 Common Squirrels (*Sciurus vulgaris*). Presented by Miss Dorothy Reynolds.
15. 1 Broad-fronted Crocodile (*Osteolæmus tetraspis*). Presented by Kenneth A. Macdonald, Esq., Lieut. A.S.C.
16. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by H. Belier, Esq.
1 Clouded Tiger (*Felis nebulosa*), ♀. Purchased.
2 Nicobar Pigeons (*Calœnas nicobarica*). Presented by W. H. St. Quintin, Esq., F.Z.S.
3 Cape Vipers (*Causus rhombeatus*). Presented by S. B. Carlill, Esq.
1 Puff-Adder (*Bitis arietans*). Presented by S. B. Carlill, Esq.
1 Rough-keeled Snake (*Dasypeltis scabra*). Presented by S. B. Carlill, Esq.
18. 2 Black-headed Jackals (*Canis mesomelas*). Presented by the Hon. James D. Logan, jun.
19. 1 Macaque Monkey (*Macacus cynomolgus*). Born in the Menagerie.
20. 1 Black-backed Jackal (*Canis mesomelas*). Presented by Wm. Hare, Esq.
1 Black-backed Jackal (*Canis mesomelas*). Presented by the Trustees of the South-African Museum.
21. 2 Coscoroba Swans (*Coscoroba candida*). Purchased.
1 Hybrid Macaque Monkey (bred between *Macacus cynomolgus* ♂ and *M. rhesus* ♀). Born in the Menagerie.
1 Golden Agouti (*Dasyprocta aguti*). Presented by Dr. G. L. Johnson, F.Z.S.
23. 1 Tawny Owl (*Syrnium aluco*). Presented by Lady Evelyn Riddell.
1 Common Kestrel (*Tinnunculus alaudarius*). Presented by Lady Evelyn Riddell.
1 White-tailed Sea-Eagle (*Haliaëtus albicilla*). From Egypt. Presented by Dixon Bey.
1 Great Black-headed Gull (*Larus ichthyaëtus*). From Egypt. Presented by Dixon Bey.
1 Crested Porcupine (*Hystrix cristata*). Born in the Menagerie.
24. 1 Vervet Monkey (*Cercopithecus lalandii*). Presented by J. E. Matcham, Esq., C.M.Z.S.
1 Levaillant's Cynictis (*Cynictis penicillata*). Presented by J. E. Matcham, Esq., C.M.Z.S.
1 Suricate (*Suricata tetradactyla*). Deposited.
25. 1 Long-tailed Duck (*Harelda glacialis*), ♂. Purchased.

Mar. 27. 1 Bay-thighed Monkey (*Cercopithecus ignitus*), ♂. Presented by J. F. Braham, Esq.
1 Green Monkey (*Cercopithecus callitrichus*). Presented by J. F. Braham, Esq.
1 Vulpine Phalanger (*Trichosurus vulpecula*). Presented by S. Humble, Esq.
28. 1 Pel's Owl (*Scotopelia peli*). From the Niger Territory, West Africa. Presented by E. V. Turner, Esq., Lt. R.E. See P. Z. S. 1899, p. 428.
29. 1 Bless-bok (*Damaliscus albifrons*), ♂. Deposited.
1 Red-faced Ouakari (*Ouacaria rubicunda*), ♀. Purchased.
1 Naked-throated Bell-bird (*Chasmorhynchus nudicollis*). Purchased.
3 Pileated-bearded Jays (*Cyanocorax pileatus*). Purchased.
2 Ravens (*Corvus corax*). Presented by Francis Walpole, Esq.
30. 1 Lesser White-nosed Monkey (*Cercopithecus petaurista*). Presented by Capt. F. E. Bishop.
31. 1 Cape Jumping-Hare (*Pedetes caffer*). Presented by W. Champion, Esq. See P. Z. S. 1899, p. 428.

Apr. 1. 1 Giraffe (*Giraffa camelopardalis capensis*), ♂. Purchased. See P. Z. S. 1899, p. 595.
1 Eland (*Oreas canna*), ♀. Purchased.
1 Eland (*Oreas canna*), ♂. Deposited.
4. 1 Lapwing (*Vanellus vulgaris*). Purchased.
5. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by David M. Greig, Esq.
6. 2 Western Pin-tailed Sand-Grouse (*Pterocles pyrenaica*). Deposited.
7. 4 Masked Hawfinches (*Coccothraustes personatus*). Purchased. See P. Z. S. 1899, p. 596.
10. 1 Common Badger (*Meles taxus*). Presented by Geo. M. Margon-Wilson, Esq.
1 Silver-backed Fox (*Canis chama*). Presented by C. R. Rennie, Esq.
11. 2 Black Rats (*Mus rattus*, var.). Presented by W. J. Smith, Esq.
14 Golden Carp (*Carassius auratus*). Purchased.
13. 2 Black-headed Buntings (*Emberiza melanocephala*), ♂ ♀. Purchased.
1 Puffin (*Fratercula arctica*). Purchased.
14. 1 Common Camel (*Camelus dromedarius*), ♂. Deposited.
15. 1 Purple-faced Monkey (*Semnopithecus cephalopterus*), ♀. Deposited.
2 Canada Geese (*Bernicla canadensis*). Purchased.
17. 1 Macaque Monkey (*Macacus cynomolgus*) (var.), ♀. Deposited.
2 Brush-Turkeys (*Talegalla lathami*). Purchased.
3 Pectoral Quails (*Coturnix pectoralis*). Purchased.
1 Varied Hemipode (*Turnix varia*). Purchased.
5 Barbary Wild Sheep (*Ovis tragelaphus*), 3 ♂, 2 ♀. Born in the Menagerie.
2 Green Glossy Starlings (*Lamprocolius chalybeus*). Purchased.
19. 1 Yellow-whiskered Lemur (*Lemur xanthomystax*). Born in the Menagerie.
2 White-backed Trumpeters (*Psophia leucoptera*). Purchased.
20. 1 Brazilian Tapir (*Tapirus americanus*), ♂. Deposited.

Apr. 20. 1 Great Bustard (*Otis tarda*), ♂. Deposited.
1 Black-shouldered Kite (*Elanus cæruleus*). Presented by J. D. Waley, Esq.
21. 3 Anoas (*Anoa depressicornis*), 2 ♂, 1 ♀. Deposited.
2 Himalayan Monauls (*Lophophorus impeyanus*), 2 ♂. Presented by Mrs. Barnewell Eliot.
24. 1 Indian Pigmy Goose (*Nettopus coromandelianus*), ♂. Presented by H.G. the Duke of Bedford, F.Z.S.
2 Concave-casqued Hornbills (*Dichoceros bicornis*), ♂ ♀. Purchased.
25. 3 Ostriches (*Struthio camelus*), 3 ♀. Presented by G. Fanshawe Abadie, Esq. See P. Z. S. 1899, p. 596.
1 Delalande's Gecko (*Tarentola delalandii*). Presented by Miss Shenton.
26. 1 Salvadori's Cassowary (*Casuarius salvadorii*). Deposited.
1 Beccari's Cassowary (*Casuarius beccarii*). Deposited.
1 Blue-necked Cassowary (*Casuarius intensus*). Deposited.
5 Radiolated Terrapins (*Hydraspis radiolata*). Deposited.
1 Derbian Sternothere (*Sternothærus derbianus*). Deposited.
1 Black Sternothere (*Sternothærus niger*). Deposited.
2 Double-banded Sand-Grouse (*Pterocles bicinctus*), 2 ♀. Presented by W. H. St. Quintin, Esq., F.Z.S.
1 Lesser Pin-tailed Sand-Grouse (*Pterocles exustus*), ♀. Presented by W. H. St. Quintin, Esq., F.Z.S.
1 Macqueen's Bustard (*Houbara macqueeni*). Presented by B. T. Finch, Esq., C.I.E., F.Z.S.
2 Black-necked Swans (*Cygnus nigricollis*). Deposited.
27. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Deposited.
28. 1 Common Raccoon (*Procyon lotor*). Presented by Master Eric Mellin.
1 Beech-Marten (*Mustela foina*). Presented by Master Eric Mellin.
1 King Parrakeet (*Aprosmictus cyanopygius*), ♂. Presented by C. W. Chambers, Esq.
1 Feline Dourocouli (*Nyctipithecus vociferans*). Presented by Mrs. Firman.
20. 1 Great Kangaroo (*Macropus giganteus*), ♂. Deposited.

May 1. 2 Squirrel-like Phalangers (*Petaurus sciureus*), ♂ ♀. Presented by A. V. Willcox, Esq.
4 Dormouse Phalangers (*Dromicia nana*). Presented by Dr. McDougall.
2. 1 Grecian Ibex (*Capra ægagrus*), ♂. Deposited.
1 Two-wattled Cassowary (*Casuarius bicarunculatus*). Deposited.
1 Drill (*Cynocephalus leucophæus*). Deposited.
1 Ichneumon (*Herpestes* sp. inc.). From Fernando Po. Deposited.
1 Pardine Genet (*Genetta pardina*). Deposited.
1 Gambian Pouched Rat (*Cricetomys gambianus*). Deposited.
2 Larger Tree-Ducks (*Dendrocygna major*). Purchased.
3. 2 Mozambique Monkeys (*Cercopithecus pygerythrus*). Presented by Boyd Alexander, Esq.
1 Sykes's Monkey (*Cercopithecus albigularis*). Presented by Boyd Alexander, Esq.
1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mrs. Herbert Peel.

May 3. 1 Bell's Cinixys (*Cinixys belliana*). Deposited.
1 Home's Cinixys (*Cinixys homeana*). Deposited.
1 Derbian Sternothere (*Sternothærus derbiana*). Deposited.
4. 1 Greater Black-headed Gull (*Larus marinus*). Presented by the Rev. W. B. Tracy.
1 Lesser Black-backed Gull (*Larus fuscus*). Presented by the Rev. W. B. Tracy.
6. 1 Mountain Zebra (*Equus zebra*), ♂. Purchased. See P. Z. S. 1899, p. 712.
1 Slow Loris (*Nycticebus tardigradus*). Presented by W. H. St. Quintin, Esq., F.Z.S.
1 Moufflon (*Ovis musimon*), ♀. Born in the Menagerie.
8. 1 Common Badger (*Meles taxus*), ♀. Presented by John N. Docwra, Esq.
9. 1 Ring-tailed Lemur (*Lemur catta*), ♀. Presented by Mrs. Penn Curzon.
1 South Albemarle Tortoise (*Testudo vicina*). Deposited.
1 Spiny-tailed Iguana (*Ctenosaura acanthura*). Deposited.
10. 1 Angolan Vulture (*Gypohierax angolensis*). From the Upper Benue River, N.W. Africa. Presented by Staff-Sergt. Patten.
11. 2 Common Marmosets (*Hapale jacchus*). Deposited.
12. 1 Reticulated Python (*Python reticulatus*). Deposited.
1 Common Snake (*Tropidonotus natrix*). Presented by E. C. Brook, Esq.
13. 1 Hoary Snake (*Pseudaspis cana*). Presented by J. E. Matcham, Esq., C.M.Z.S.
1 Rough-keeled Snake (*Dasypeltis scabra*). Presented by J. E. Matcham, Esq., C.M.Z.S.
3 Rhomb-marked Snakes (*Trimerorhinus rhombeatus*). Presented by J. E. Matcham, Esq., C.M.Z.S.
2 Crossed Snakes (*Psammophis crucifer*). Presented by J. E. Matcham, Esq., C.M.Z.S.
14. 2 Crowned Lemurs (*Lemur coronatus*). Born in the Menagerie.
15. 1 Green Monkey (*Cercopithecus callitrichus*), ♂. Presented by J. B. Robinson, Esq., F.Z.S.
1 Sociable Vulture (*Vultur auricularis*). From Egypt. Presented by H.G. the Duchess of Marlborough.
6 Derbian Zonures (*Zonurus giganteus*). Presented by W. P. Westermeyer, Esq.
16. 1 Green Monkey (*Cercopithecus callitrichus*), ♀. Presented by H. Gifford, Esq.
17. 1 Black Kite (*Milvus migrans*). Presented by G. H. Walker, Esq.
18. 1 Yellow-whiskered Lemur (*Lemur xanthomystax*), ♂. Presented by C. B. Ayerst, Esq., and Miss Mary F. Ayerst.
1 Common Duiker (*Cephalophus grimmi*), ♂. Presented by W. Champion, Esq.
1 Banded Ichneumon (*Crossarchus fasciatus*). Presented by W. Champion, Esq.
2. Common Snakes (*Tropidonotus natrix*). Presented by E. Haig, Esq.
19. 1 Chimpanzee (*Anthropopithecus troglodytes*), ♀. Deposited.
1 Slaty Buzzard (*Buteo poliosoma*?). Presented by Capt. Bate.
22. 1 Mexican Guan (*Ortalis vetula*). Presented by Capt. W. H. Milner.

May 23. 1 Palm-Squirrel (*Sciurus palmarum*). Presented by Miss Aggie O'Connor.

24. 1 Milne-Edwards's Cassowary (*Casuarius edwardsi*). Deposited.
1 Mauve-necked Cassowary (*Casuarius violicollis*). Deposited.
4 Elephantine Tortoises (*Testudo elephantina*). Deposited.
2 Starred Tortoises (*Testudo elegans*). Deposited.
1 White-throated Monitor (*Varanus albigularis*?). Deposited.

25. 1 Kinkajou (*Cercoleptes caudivolvulus*), ♀. Presented by J. J. Quelch, Esq., C.M.Z.S.
1 Martinique Gallinule (*Ionornis martinicus*). Presented by H. O. Milner, Esq.

26. 1 Westermann's Cassowary (*Casuarius westermanni*). Deposited.
1 Common Cassowary (*Casuarius galeatus*). Deposited.
3 Rabbit-eared Bandicoots (*Peragale lagotis*), 3 ♂. Deposited.
2 Spotted Bower-birds (*Chlamydodera maculata*). Deposited.
1 Leith's Tortoise (*Testudo leithi*). Presented by S. S. Flower, Esq., F.Z.S.

27. 1 Smooth-headed Capuchin (*Cebus monachus*). Presented by Herbert Gibson, Esq.
1 Black-tailed Wallaby (*Macropus ualabatus*), ♀. Deposited.

29. 2 Black-striped Wallabies (*Halmaturus dorsalis*), ♂ ♀. Presented by Thos. Taylor, Esq., F.Z.S.
1 Common Kingfisher (*Alcedo ispida*). Presented by Ronald Edwards, Esq.

30. 1 Musk-Duck (*Biziura lobata*). Purchased. See P. Z. S. 1899, p. 712.
2 Collared Fruit-Bats (*Cynonycteris collaris*). Born in the Menagerie.

31. 2 Stonechats (*Pratincola rubicola*). Deposited.
3 Barbary Turtle-Doves (*Turtur risorius*), 1 ♂, 2 ♀. Purchased.

June 1. 1 Rufous Tinamou (*Rhynchotus rufescens*). Presented by Henry Bell, Esq.
1 South Albemarle Tortoise (*Testudo vicina*). Deposited.

2. 1 Green Monkey (*Cercopithecus callitrichus*), ♀. Presented by Dr. H. Strachan.
2 Derbian Parrakeets (*Palæornis derbyana*). Deposited.
2 Jackdaws (1 albino) (*Corvus monedula*). Presented by Eardley Wilmot B. Holt, Esq., F.Z.S.
1 Tuatera Lizard (*Sphenodon punctatus*). Purchased.
2 Green Turtles (*Chelone mydas*). Presented by Capt. Geo. G. C. Stevenson.

3. 2 Secretary Vultures (*Serpentarius reptilivorus*). Presented by J. E. Matcham, Esq., C.M.Z.S.

5. 1 Sooty Mangabey (*Cercocebus fuliginosus*), ♀. Presented by G. Le Fantt, Esq.
1 Echidna (*Echidna hystrix*). Deposited.
1 Blue-necked Cassowary (*Casuarius intensus*). Deposited.
1 Brown Gannet (*Sula leucogastra*). Presented by Miss Williams.
1 Hunting-Crow (*Cissa venatoria*). Purchased.
2 Common Vipers (*Vipera berus*). Presented by Chas. C. Dallas, Esq.

6. 2 Slender Loris (*Loris gracilis*). Presented by Stanley S. Flower, Esq., F.Z.S.

June 6. 1 Two-spotted Paradoxure (*Nandinia binotata*). Presented by Arthur Knights, Esq.
1 Algerian Skink (*Eumeces algeriensis*). Presented by R. H. Archer, Esq.
7. 1 Leopard (*Felis pardus*). Presented by Edward Booth, Esq.
1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
1 English Wild Cow (*Bos taurus*). Born in the Menagerie.
2 Squirrel-like Phalangers (*Petaurus sciureus*), 2 ♀. Born in the Menagerie.
2 Short-headed Phalangers (*Petaurus breviceps*), 2 ♂. Born in the Menagerie.
1 White-backed Piping-Crow (*Gymnorhina leuconota*). Presented by G. T. Harris, Esq.
10 Green Lizards (*Lacerta viridis*). Purchased.
14 Yellow-bellied Toads (*Bombinator bombinus*). Purchased.
8. 3 Barbary Turtle-Doves (*Turtur risorius*). Presented by Col. F. J. Gardiner, F.Z.S.
3 Bar-tailed Godwits (*Limosa lapponica*). Purchased.
4 Black-tailed Godwits (*Limosa ægocephala*). Purchased.
1 Rutescent Snake (*Leptodira hotambœia*). Presented by W. Champion, Esq.
1 Hissing Sand-Snake (*Psammophis sibilans*). Presented by W. Champion, Esq.
2 Mute Swans (*Cygnus olor*), 2 ♂. Deposited.
9. 1 Vervet Monkey (*Cercopithecus lalandii*). Presented by Mr. G. F. Marson.
1 Patagonian Cavy (*Dolichotis patachonica*). Bred in the Menagerie.
1 Crested Porcupine (*Hystrix cristata*). Bred in the Menagerie.
2 Hybrid Herring-Gulls (*Larus argentatus* ♂ × *Larus cachinnans* ♀). Bred in the Menagerie.
10. 2 Mauve-necked Cassowaries (*Casuarius violicollis*). Deposited.
1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Mrs. C. Farrant.
1 Senegal Parrot (*Pœocephalus senegalus*). Deposited.
1 Black-backed Jackal (*Canis mesomelas*). Presented by Mr. David D. Keith.
11. 1 Hybrid Lemur (*Lemur macaco* ♂ × *Lemur brunneus* ♀). Born in the Menagerie.
12. 2 Blue-bearded Jays (*Cyanocorax cyanopogon*). Presented by Arthur Ussher, Esq.
1 Laughing Kingfisher (*Dacelo gigantea*). Presented by the Hon. A. Littleton.
1 Greater Sulphur-crested Cockatoo (*Cacatua galerita*). Deposited.
2 Derbian Screamers (*Chauna derbiana*). Purchased.
13. 1 Hoolock Gibbon (*Hylobates hoolock*), ♂. Presented by S. B. Bates, Esq.
2 Black-bellied Sand-Grouse (*Pterocles arenarius*), ♂♀. Presented by G. P. Torrens, Esq.
12 Sharp-headed Lizards (*Lacerta dugesi*). Presented by R. H. Archer, Esq.
14. 1 Burrhel Wild Sheep (*Ovis burrhel*), ♀. Born in the Menagerie.
2 Green Lizards (*Lacerta viridis*). Presented by the Rev. F. W. Haines.
1 Tessellated Snake (*Tropidonotus tessellatus*). Presented by the Rev. F. W. Haines.

June 14. 1 Common Snake (*Tropidonotus natrix*). Presented by the Rev. F. W. Haines.
15. 1 Northern Mocking-bird (*Mimus polyglottus*). Presented by C. Gilbert, Esq.
2 Jameson's Gulls (*Larus novæ-hollandiæ*). Bred in the Menagerie.
17. 2 Spiny-tailed Iguanas (*Ctenosaura acanthura*). Deposited.
1 Diamond Python (*Python spilotes*). Purchased.
2 Palm-Squirrels (*Sciurus palmarum*). Purchased.
18. 1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
1 Burrhel Wild Sheep (*Ovis burrhel*), ♂. Born in the Menagerie.
19. 1 Reticulated Python (*Python reticulatus*). Deposited.
20. 2 Stone-Curlews (*Œdicnemus scolopax*). Presented by D. F. Campbell, Esq.
21. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mrs. L. Smallcombe.
22. 1 Toltec Deer (*Cariacus toltecus*), ♂. From Tobago. Deposited.
1 Yellow-crowned Penguin (*Eudyptes antipodum*). Deposited.
1 Thick-billed Penguin (*Eudyptes pachyrhynchus*). From Stewart Island, New Zealand. Deposited.
1 Rock-hopper Penguin (*Eudyptes chrysocome*). Deposited.
2 Elephantine Tortoises (*Testudo elephantina*). Deposited.
6 Common Cormorants (*Phalacrocorax carbo*). Presented by Percy Leigh Pemberton, Esq.
23. 1 Diana Monkey (*Cercopithecus diana*), ♀. Presented by T. N. Loy, Esq.
2 Coscoroba Swans (*Coscoroba candida*). Purchased.
24. 1 Selous's Antelope (*Tragelaphus selousi* : see *Tragelaphus spekii*, P. Z. S. 1899, p. 824), ♂. Received in Exchange.
1 Red Deer (*Cervus elaphus*), ♂. Born in the Menagerie.
1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mr. J. H. Johnston.
26. 1 Wapiti Deer (*Cervus canadensis*), ♂. Born in the Menagerie.
1 Cormorant (*Phalacrocorax carbo*). Presented by Percy Leigh Pemberton, Esq.
12 African Walking-fish (*Periophthalmus koelreuteri*). Presented by Dr. H. O. Forbes, F.Z.S.
27. 1 Tabuan Parrakeet (*Pyrrhulopsis tabuensis*). Deposited.
28. 1 Common Paradoxure (*Paradoxurus niger*). Presented by J. Osborne, Esq.
2 Carrion-Crows (*Corvus corone*). Presented by Lieut.-Col. Vilett Rolleston, F.Z.S.
30. 2 Slender Ichneumons (*Herpestes gracilis*). Deposited.
1 Red-bellied Tamarin (*Midas labiatus*). Deposited.
1 Brown Mouse-Lemur (*Chirogaleus milii*). Deposited.
2 Mexican Conures (*Conurus holochlorus*). Deposited.
1 Rock-Thrush (*Monticola saxatilis*). Presented by H. J. Fulljames, Esq.
1 Yellow Hangnest (*Cassicus persicus*). Presented by H. J. Fulljames, Esq.

July 1. 1 Barbary Mouse (*Mus barbarus*). Presented by Miss M. H. Lyell.
2. 1 Great Eagle-Owl (*Bubo maximus*). Bred in the Menagerie.
3. 1 Arabian Baboon (*Cynocephalus hamadryas*?), ♀. Deposited. From Marocco.

July 3. 3 Barbary Partridges (*Caccabis petrosa*). Deposited.
3 Pin-tailed Sand-Grouse (*Pterocles alchata*). Deposited.
3 Barbary Turtle-Doves (*Turtur risorius*). Deposited.
3 Algerian Chaffinches (*Fringilla spodiogena*). Deposited.
1 Spanish Sparrow (*Passer salicicola*). Deposited.
1 Black-headed Finch (*Munia malacca*). Deposited.
1 Chestnut-bellied Finch (*Munia rubro-nigra*). Deposited.
1 Serin Finch (*Serinus hortulanus*). Deposited.
1 Crested Coot (*Fulica cristata*). Deposited.
2 Lanner Falcons (*Falco lanarius*). Presented by Sir Harry Johnston, K.C.B., F.Z.S.
1 Yellow-fronted Amazon (*Chrysotis ochrocephala*). Presented by Mrs. G. T. Cox.
2 Common Badgers (*Meles taxus*). Presented by A. Gorham, Esq.

4. 1 Grand Galago (*Galago crassicaudatus*). Deposited.
3 Black-headed Terrapins (*Damonia reevesi unicolor*). Deposited.
1 Salt-water Terrapin (*Malacoclemmys terrapin*). Deposited.
1 Painted Terrapin (*Chrysemys picta*). Deposited.
3 Reeves's Terrapins (*Damonia reevesi*). Deposited.
1 Home's Cinixys (*Cinixys homeana*). Deposited.
1 Derbian Sternothere (*Sternothærus derbianus*). Deposited.
1 Macaque Monkey (*Macacus cynomolgus*). Presented by J. H. Higgins, Esq.
1 Hunting-Crow (*Cissa venatoria*).
1 Black-necked Grakle (*Gracupica nigricollis*).
1 Larger Racket-tailed Drongo (*Dissemurus paradiseus*).
1 Sacred Kingfisher (*Halcyon sancta*).
1 Black Hangnest (*Cassidix oryzivora*).
1 Blackbird (*Turdus merula*).
1 Grey-winged Blackbird (*Turdus pœciloptera*).
1 Brown Thrush (*Turdus leucomelas*).
1 Brown Mock-Thrush (*Harporhynchus rufus*).
} Presented by Russell Humphrys, Esq.

5. 1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
4 Rosy-billed Ducks (*Metopiana pepesaca*), 2♂, 2♀. Purchased.

6. 2 Maholi Galagos (*Galago maholi*). Presented by the Hon. Mrs. Gilbert Johnstone.
1 North-African Jackal (*Canis anthus*). Purchased.
4 Crested Pigeons (*Ocyphaps lophotes*). Purchased.
1 Ostrich (*Struthio camelus*), ♂. Purchased.
1 Sun-Bittern (*Eurypyga helias*). Purchased.
1 Scarlet Ibis (*Eudocimus ruber*). Purchased.
1 Golden Paradoxure (*Paradoxurus aureus*). Deposited.
3 Reticulated Pythons (*Python reticulatus*). Deposited.

7. 1 Mandarin Duck (*Æx galericulata*). Bred in the Menagerie.
4 Summer Ducks (*Æx sponsa*). Bred in the Menagerie.
4 Variegated Sheldrakes (*Tadorna variegata*). Bred in the Menagerie.
4 Upland Geese (*Chloëphaga magellanica*). Bred in the Menagerie.
1 Horseshoe Snake (*Zamenis hippocrepis*). Purchased.

8. 1 Spring-bok (*Gazella euchore*), ♂. Presented by J. E. Matcham, Esq., C.M.Z.S.
4 Spur-winged Geese (*Plectropterus gambensis*). Presented by J. E. Matcham, Esq., C.M.Z.S.

July 8. 1 Ring-hals Snake (*Sepedon hæmachates*). Presented by J. E. Matcham, Esq., C.M.Z.S.

10. 1 Bonnet-Monkey (*Macacus sinicus*), ♂. Presented by Miss Nesta Bevan.
1 Japanese Deer (*Cervus sika*), ♀. Born in the Menagerie.
1 Common Peafowl (*Pavo cristatus*), ♂. Presented by Miss A. S. Heldmann.

11. 1 Black-faced Spider-Monkey (*Ateles ater*). Presented by Mrs. K. E. Mackenzie.
5 Common Hedgehogs (*Erinaceus europæus*). Presented by Geo. Long, Esq.
2 Mauve-necked Cassowaries (*Casuarius violicollis*). Deposited.
1 European Pond-Tortoise (*Emys orbicularis*). Deposited.

12. 2 Campbell's Monkeys (*Cercopithecus campbelli*), ♂ ♀. Presented by Capt. F. R. B. Parmeter.
2 Common Foxes (*Canis vulpes*). Presented by A. H. Britten, Esq.
2 Syrian Bulbuls (*Pycnonotus xanthopygos*). Deposited.
2 Climbing Fishes (*Anabas scandens*). Presented by P. Barford, Esq.

13. 1 Arabian Gazelle (*Gazella arabica*). Presented by B. T. Ffinch, Esq., F.Z.S.
1 Mozambique Monkey (*Cercopithecus pygerythrus*). Presented by B. T. Ffinch, Esq., F.Z.S.
3 Chipping Squirrels (*Tamias striatus*). Presented by the Rev. A. E. Tollemache.
2 Rose-coloured Pastors (*Pastor roseus*). Purchased.
2 Indian Mynahs (*Acridotheres ginginianus*). Purchased.
1 Silky Starling (*Poliopsar sericeus*). Purchased.

14. 1 Arctic Fox (*Canis lagopus*). Presented by M. Magnusson, Esq.
2 Rheas (white var.) (*Rhea americana*). Deposited.
2 Lunulated Honey-eaters (*Melithreptes lunulatus*). Purchased.
2 Fuscous Honey-eaters (*Ptilotis fuscus*). Purchased.
2 Pied Grallinas (*Grallina australis*). Purchased.
2 Musky Lorikeets (*Glossopsittacus concinnus*). Purchased.
2 Bamboo Partridges (*Bambusicola thoracica*). Purchased.

15. 1 Common Cassowary (*Casuarius galeatus*). Deposited.

17. 1 Burchell's Zebra (*Equus burchelli*), ♀. Deposited.
2 Collared Fruit-Bats (*Cynonycteris collaris*). Born in the Menagerie.
1 Blood-rumped Parrakeet (*Psephotus hæmatonotus*), ♀. Presented by Mrs. A. Chambers.
1 Rock-Thrush (*Monticola saxatilis*). Received in Exchange.
2 Common Cormorants (*Phalacrocorax carbo*). Presented by P. L. Pemberton, Esq.

18. 1 Feline Douroucouli (*Nyctipithecus vociferans*). Presented by Mrs. Arthur Harter.
1 Burrhel Wild Sheep (*Ovis burrhel*), ♀. Born in the Menagerie.
3 Adorned Terrapins (*Chrysemys ornata*). Presented by C. J. Rickards, Esq.

19. 1 Anubis Baboon (*Cynocephalus anubis*), ♀. From Accra. Presented by G. B. Haddon Smith, Esq.

20. 1 Ring-tailed Lemur (*Lemur catta*). Presented by Mrs. T. Butt Miller.
2 Hairy Armadillos (*Dasypus villosus*). Deposited.

July 20. 1 Ground Hornbill (*Bucorvus abyssinicus*). Presented by Geo. Hirst, Esq. See P. Z. S. 1899, p. 824.
1 Blood-rumped Parrakeet (*Psephotus hæmatonotus*), ♂. Presented by Mrs. A. Chambers.
21. 1 Lion Marmoset (*Midas rosalia*). Presented by Capt. Chawner.
1 Spotted Ichneumon (*Herpestes auro-punctatus*). Presented by Mr. Geo. F. Aress.
1 Levaillant's Cynictis (*Cynictis penicillata*). Presented by J. E. Matcham, Esq., C.M.Z.S.
2 Bristly Ground-Squirrels (*Xerus setosus*). Presented by J. E. Matcham, Esq., C.M.Z.S.
1 Cape Pouched Rat (*Saccostomus campestris*). Presented by J. E. Matcham, Esq., C.M.Z.S.
1 Blue-fronted Amazon (*Chrysotis æstiva*). Deposited.
22. 1 Golden Eagle (*Aquila chrysaëtus*). Presented by H. C. Ross, Esq.
1 Chattering Lory (*Lorius garrulus*). Purchased.
1 Common Duiker (*Cephalophus grimmi*), ♂. Presented by Capt. G. C. Denton, C.M.G., F.Z.S.
24. 1 Common Badger (*Meles taxus*), ♀. Presented by Mrs. F. Travers.
25. 2 Common Wolves (*Canis lupus*), ♂ ♀. Purchased. From Siberia.
26. 1 Zebu (*Bos indicus*), ♂. Presented by C. A. Smith Ryland, Esq.
2 Common Squirrels (*Sciurus vulgaris*). Presented by Miss E. B. Sparrow.
1 Common Badger (*Meles taxus*). Deposited. From Siberia.
1 Common Hamster (*Cricetus frumentarius*). Deposited.
1 Mongolian Pheasant (*Phasianus mongolicus*). Deposited.
4 Horsfield's Tortoises (*Testudo horsfieldi*). Deposited.
2 Blackish Sternotheres (*Sternothærus nigricans*). Deposited.
1 Japanese Terrapin (*Clemmys japonica*). Deposited.
1 Serrated Terrapin (*Clemmys scripta*). Deposited.
6 Sand-Lizards (*Lacerta agilis*). Deposited.
6 Crested Anolis (*Anolis cristatellus*). Deposited.
2 Long-snouted Snakes (*Dryophis mycterizans*). Deposited.
27. 2 Tengmalm's Owls (*Nyctala tengmalmi*). Presented by P. Musters, Esq. From Norway.
1 Tui Parrakeet (*Brotogerys tui*). Presented by C. M. Hayter, Esq.
1 Martinique Gallinule (*Ionornis martinicus*). Presented by H. A. Pare, Esq.
28. 1 Purple-faced Monkey (*Semnopithecus cephalopterus*), ♂. Presented by Mrs. Usborne.
2 Yellow-tufted Honey-eaters (*Ptilotes auricomis*). Purchased.
2 Nonpareils (*Cyanospiza ciris*), ♂ ♀. Purchased.
1 Adorned Terrapin (*Chrysemys ornata*). Presented by Mrs. R. J. Aston.
1 Common Snake (*Tropidonotus natrix*). Deposited.
2 Common Vipers (*Vipera berus*). Deposited.
29. 1 Common Snake (var.) (*Tropidonotus natrix*). Presented by T. E. Gunn, Esq.
1 Glass-Snake (*Ophiosaurus apus*). Deposited.
1 Raven (*Corvus corax*). Presented by P. Stuart, Esq.
31. 1 Tantalus Monkey (*Cercopithecus tantalus*), ♀. Presented by W. Knight, Esq.

July 31. 1 Grison (*Galictis vittata*). Purchased.
1 Magpie (*Pica rustica*). Presented by S. B. Goldsmith, Esq.

Aug. 1. 2 Black-eared Marmosets (*Hapale penicillata*). Deposited.
1 Red-eared Bulbul (*Pycnonotus jocosus*). Presented by Miss Petrocochino.
1 Yellow-bellied Liothrix (*Liothrix luteus*). Presented by Miss Petrocochino.
1 Herring-Gull (*Larus argentatus*). Deposited.
2 Goshawks (*Astur palumbarius*). Presented by Mons. P. A. Pichot, C.M.Z.S.
1 Common Viper (*Vipera berus*). Presented by A. M. Rodger, Esq.
2. 1 Sooty Phalanger (*Trichosurus fuliginosus*), ♂. Deposited.
2 Maholi Galagos (*Galago maholi*). Deposited.
1 Malabar Squirrel (*Sciurus maximus dealbatus*). Deposited.
2 Hairy Armadillos (*Dasypus villosus*). Presented by Wm. Brown, Esq.
1 Geoffroy's Cat (*Felis geoffroii*). Presented by Wm. Brown, Esq.
4 Rufous Tinamous (*Rhynchotus rufescens*). Presented by Ernest Gibson, Esq.
3 Spotted Tinamous (*Nothura maculosa*). Presented by Ernest Gibson, Esq.
3. 1 Hybrid Mexican Deer (between *Cariacus mexicanus* ♂ and *Cariacus macrotis* ♀). Born in the Menagerie.
2 Superb Tanagers (*Calliste fastuosa*). Purchased.
1 Blue-and-Black Tanager (*Tanagrella cyanomelæna*). Purchased.
1 Thick-billed Tanager (*Euphonia laniirostris*). Purchased.
1 Long-necked Chelodine (*Chelodina longicollis*). Deposited.
2 Serrated Terrapins (*Chrysemys scripta*). Deposited.
4. 1 Common Mynah (*Acridotheres tristis*). Received in Exchange.
8. 1 Antillean Boa (*Boa diviniloqua*). Deposited.
9. 1 Pinche Monkey (*Midas œdipus*), ♂. Presented by R. E. Stone, Esq.
10. 1 Suricate (*Suricata tetradactyla*). Deposited.
11. 1 Common Hamster (albino) (*Cricetus frumentarius*). Deposited.
2 Spotted Turtle-Doves (*Turtur suratensis*). Bred in the Menagerie.
12. 2 Common Duikers (*Cephalophus grimmi*), ♂ ♀. Presented by J. E. Matcham, Esq., C.M.Z.S.
6 Swainson's Francolins (*Pternistes swainsoni*), 2 ♂, 4 ♀. Presented by J. E. Matcham, Esq., C.M.Z.S.
14. 2 Grévy's Zebras (*Equus grevyi*), ♂ ♀. Deposited by H.M. The Queen. See P. Z. S. 1899, p. 825.
1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
1 Common Kingfisher (*Alcedo ispida*). Presented by John Porter, Esq.
1 Brown Capuchin (*Cebus fatuellus*), ♀. Presented by Col. Bourchier.
15. 1 Alligator (*Alligator mississippiensis*). Presented by Commander H. Woodcock.
16. 1 Puma (*Felis concolor*). Born in the Menagerie.
17. 1 Malayan Bear (*Ursus malayanus*). Presented by Miss Dorothy Woolner, F.Z.S.

Aug. 17. 3 Pink-headed Ducks (*Rhodonessa caryophyllacea*), 1 ♂, 2 ♂. Purchased.
6 Edible Frogs (*Rana esculenta*). Purchased.
12 Paradise Fish (*Macropus viridi-auratus*). Purchased.
18. 1 Vervet Monkey (*Cercopithecus lalandii*), ♀. Presented by R. Hilliard, Esq.
1 Burchell's Zebra (*Equus burchelli*), ♀. Born in the Menagerie.
1 Alexandrine Parrakeet (*Palæornis alexandri*), ♀. Presented by Miss J. M. Pott.
20. 1 Common Boa (*Boa constrictor*). Presented by C. W. Lilley, Esq., F.Z.S.
21. 2 Lion Marmosets (*Midas rosalia*). Purchased.
4 Violet Tanagers (*Euphonia violacea*), 3 ♂, 1 ♀. Purchased.
1 Yellow Tanager (*Calliste flava*), ♀. Purchased.
3 Blue-shouldered Tanagers (*Tanagra cyanoptera*). Purchased.
1 Great Tanager (*Saltator magnus*). Purchased.
1 Black-headed Sugar-bird (*Chlorophanes viridis*), ♀. Purchased.
2 Natterer's Hawks (*Asturina nattereri*). Purchased.
1 Red-faced Ouakari (*Ouacaria rubicunda*). Deposited.
22. 2 Puffins (*Fratercula arctica*). Presented by R. Gordon-Smith, Esq.
23. 1 Serval (*Felis serval*). Presented by Sir R. B. Llewellyn, K.C.M.G.
24. 1 Red-vented Cockatoo (*Cacatua hæmaturopygia*). Deposited.
1 Black-necked Swan (*Cygnus nigricollis*), ♀. Purchased.
25. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by T. Mark Merriman, Esq.
1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by J. M. Skinner, Esq.
26. 1 Spotted Ichneumon (*Herpestes auro-punctatus*). Presented by Miss Jackson.
30. 1 Stone-Curlew (*Œdicnemus scolopax*). From Oxfordshire. Presented by S. M. Sargant, Esq.

Sept. 1. 1 Common Camel (*Camelus dromedarius*), ♂. From Mogador. Presented by F. G. Aflalo, Esq., F.Z.S.
1 Sykes's Monkey (*Cercopithecus albigularis*), ♂. Presented by W. P. Peyton, Esq.
3. 1 Common Raccoon (*Procyon lotor*). From Barbados. Deposited.
4. 1 West-African Python (*Python sebæ*). Presented by J. S. Budgett, Esq., F.Z.S.
5. 11 Long-nosed Crocodiles (*Crocodilus cataphractus*). From Assay, Southern Nigeria. Presented by W. J. Bowker Esq.
1 Short-tailed Vole (var.) (*Arvicola agrestis*). Presented by A. Thomas, Esq.
6. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by E. J. Mills, Esq., F.Z.S.
2 One-Wattled Cassowaries (*Casuarius uniappendiculatus*). Deposited.
1 Common Chameleon (*Chamæleon vulgaris*). Presented by Mr. H. Wish.
7. 1 Short-eared Rock-Kangaroo (*Petrogale brachyotis*), ♂. Deposited.

Sept. 7. 2 Regent-birds (*Sericulus melinus*). Deposited.
1 Blue-necked Cassowary (*Casuarius intensus*). Deposited.
1 Ring-necked Parrakeet (*Palæornis torquata*). Deposited.
1 Serrated Terrapin (*Chrysemys scripta*). Deposited.
1 Grooved Tortoise (*Testudo calcarata*). Deposited.
1 Leadbeater's Cockatoo (*Cacatua leadbeateri*). Presented by Lieut.-Col. G. E. E. Blunt.
8. 1 Laughing Kingfisher (*Dacelo gigantea*). Presented by Thomas A. de Wolf, Esq.
11. 1 Kinkajou (*Cercoleptes caudivolvulus*). Deposited.
1 Arctic Fox (*Canis lagopus*). Deposited.
1 Fulmar (*Fulmarus gracilis*). Presented by G. S. Hett, Esq.
12. 1 Maholi Galago (*Galago maholi*). Presented by James W. Park, Esq.
1 Lapwing (*Vanellus vulgaris*). Presented by the Rev. A. Barham Hutton.
2 Common Chameleons (*Chamæleon vulgaris*). Presented by Ronald H. Archer, Esq.
3 Armoured Cat-fish (*Callichthys paleatus*). Deposited.
13. 2 Black-eared Marmosets (*Hapale penicillata*). Presented by F. M. Still, Esq.
1 Common Viper (*Vipera berus*). Presented by P. Debell Tuckett, Esq.
14. 1 Palm-Squirrel (albino) (*Sciurus palmarum* ?). Deposited.
1 Black-headed Conure (*Conurus nanday*). Deposited.
1 Herring-Gull (*Larus argentatus*). Presented by J. L. Bell, Esq.
15. 1 Guinea Baboon (*Cynocephalus sphinx*), ♀. Presented by Mr. J. Huxley.
1 Black-backed Jackal (*Canis mesomelas*).
4 Bristly Ground-Squirrels (*Xerus setosus*).
1 Vulturine Eagle (*Aquila verreauxi*).
2 Hispid Lizards (*Agama hispida*).
4 Delalande's Lizards (*Nucras delalandii*).
7 Rufescent Snakes (*Leptodira hotambœia*).
4 Crossed Snakes (*Psammophis crucifer*).
5 Rhomb-marked Snakes (*Trimerorhinus rhombeatus*).
8 Rough-keeled Snakes (*Dasypeltis scabra*).
1 Infernal Snake (*Boodon infernalis*).
2 Puff-Adders (*Bitis arietans*).
} Presented by J. E. Matcham, Esq., C.M.Z.S.
18. 1 African Civet Cat (*Viverra civetta*). Presented by W. W. Hardwick, Esq., R.N.
19. 1 Two-spotted Paradoxure (*Nandinia binotata*). Presented by F. Gordon, Esq.
20. 4 Green Lizards (*Lacerta viridis*). Presented by F. R. Preston, Esq.
21. 1 Black-backed Kaleege (*Euplocamus melanonotus*), ♀. Presented by W. F. Pedler, Esq.
2 Sonnerat's Jungle-fowls (*Gallus sonnerati*), 2 ♀. Presented by W. F. Pedler, Esq.
1 Wood-Francolin (*Francolinus gularis*). Presented by W. F. Pedler, Esq.
22. 1 Hocheur Monkey (*Cercopithecus nictitans*). Deposited.
1 Maroon Oriole (*Oriolus traillii*). Deposited.
1 Rüppell's Parrot (*Pœocephalus rueppelli*). Deposited.
2 Radiated Tortoises (*Testudo radiata*). Deposited.

Sept. 23. 2 Black-eared Marmosets (*Hapale penicillata*). Deposited.
1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Dr. Montgomery Smith.
25. 4 Blanding's Terrapins (*Emys blandingi*). Deposited.
1 Prickly Trionyx (*Trionyx spinifer*). Deposited.
26. 1 Black-necked Swan (*Cygnus nigricollis*), ♀. Purchased.
1 Hoopoe (*Upupa epops*). Purchased.
2 Sandpipers (*Tringoides hypoleucus*). Purchased.
28. 1 Ruffed Lemur (*Lemur varius*). Deposited.
2 Westerman's Eclectus (*Eclectus westermani*), 2 ♂. Deposited.
1 Two-spotted Paradoxure (*Nandinia binotata*). Deposited.
1 Rufous Tinamou (*Rhynchotus rufescens*). Deposited.
29. 1 Grey Ichneumon (*Herpestes griseus*). Deposited.
5 Barbary Turtle-Doves (*Turtur risorius*). Presented by Mrs. J. A. Moore.
30. 2 Lanceolated Jays (*Garrulus lanceolatus*). Purchased.
1 Westerman's Eclectus (*Eclectus westermani*), ♀. Deposited.

Oct. 2. 1 Brown Capuchin (*Cebus fatuellus*), ♂. Deposited.
3. 2 Baillon's Aracaris (*Andigena bailloni*). Purchased.
12 Dwarf Chameleons (*Chamæleon pumilus*). Purchased.
4. 1 Guinea Baboon (*Cynocephalus sphinx*), ♂. Deposited.
2 Squirrel-like Phalangers (*Petaurus sciureus*), 2 ♂. Born in the Menagerie.
1 Striped Snake (*Tropidonotus ordinatus sirtalis*). Deposited.
3 Common Snakes (*Tropidonotus natrix*). Deposited.
1 Tessellated Snake (*Tropidonotus tessellatus*). Deposited.
1 Four-lined Snake (*Coluber quatuorlineatus*). Deposited.
1 Smooth Snake (*Coronella austriaca*). Deposited.
1 Glass-Snake (*Ophiosaurus apus*). Deposited.
1 Eyed Lizard (*Lacerta ocellata*). Deposited.
6 Slowworms (*Anguis fragilis*). Deposited.
5. 1 Wapiti Deer (*Cervus canadensis*). Born in the Menagerie.
1 Axis Deer (*Cervus axis*), ♂. Born in the Menagerie.
3 Palm-Squirrels (*Sciurus palmarum*). Presented by Mrs. M. E. Tracey.
1 White-browed Amazon (*Chrysotis albifrons*). Purchased.
2 Orange-flanked Parrakeets (*Brotogerys pyrrhopterus*). Presented by W. H. St. Quintin, Esq., F.Z.S.
6. 4 Red-crested Pochards (*Fuligula rufina*), 2 ♂, 2 ♀. Purchased.
7. 1 Smooth-headed Capuchin (*Cebus monachus*), ♀. Presented by M. P. Peeker, Esq.
1 Chopi Starling (*Aphobus chopi*). Presented by W. R. Routledge, Esq.
9. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mrs. J. Adams.
1 Common Seal (*Phoca vitulina*). Deposited.
1 Common Cormorant (var.) (*Phalacrocorax carbo*). Deposited.
11. 1 Black-faced Spider-Monkey (*Ateles ater*). Presented by Claude P. Landi, Esq.
1 Emu (*Dromœus novæ-hollandiæ*). Deposited.
6 Glossy Ibises (*Plegadis falcinellus*). Bred in the Menagerie.
3 Long-necked Chelodines (*Chelodina longicollis*). Deposited.
12. 1 Red-cheeked Souslik (*Spermophilus erythrogenys*). Deposited.
4 Eversmann's Sousliks (*Spermophilus altaicus*). Deposited.
4 Altai Sousliks (*Spermophilus mugosaricus*). Deposited.

Oct. 12. 1 Common Chameleon (*Chamæleon vulgaris*). Presented by A. H. Ryan, Esq.
1 Uvæan Parrakeet (*Nymphicus uvæensis*). Deposited.
1 Rosy Parrakeet (*Palæornis rosa*), ♂. Deposited.
13. 1 Westerman's Eclectus (*Eclectus westermani*), ♂. Deposited.
1 Gray's Tree-frog (*Rhacophorus maculatus* var. *quadrilineata*). Deposited.
16. 1 Gambian Pouched-Rat (*Cricetomys gambianus*). Presented by Ernest E. Austen, Esq.
1 Nilotic Trionyx (*Trionyx triunguis*). Presented by Ernest E. Austen, Esq.
1 Red-footed Ground-Squirrel (*Xerus erythropus*). Presented by F. H. D. Negus, Esq.
1 Green Turtle (*Chelone viridis*). Presented by W. Hebden, Esq., C.E.
17. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by A. M. Burgess, Esq.
2 Serrated Terrapins (*Chrysemys scripta*). Deposited.
1 Shielded River-Turtle (*Emyda scutata*). Deposited.
12 Goldfinches (*Carduelis elegans*). Purchased.
12 Chaffinches (*Fringilla cœlebs*). Purchased.
6 Bullfinches (*Pyrrhula europæa*). Purchased.
18. 2 Herring-Gulls (*Larus argentatus*). Presented by J. W. Edgar, Esq.
1 Melodious Jay-Thrush (*Leucodioptron canorum*). Presented by Mrs. Currey.
1 Common Chameleon (*Chamæleon vulgaris*). Presented by F. G. Ward, Esq.
19. 1 Heck's Cassowary (*Casuarius hecki*). Deposited.
1 White Goshawk (*Astur novæ-hollandiæ*). Deposited.
1 Crab-eating Raccoon (*Procyon cancrivorus*). Purchased.
3 Short-eared Owls (*Asio brachyotus*). Purchased.
20. 1 Green Monkey (*Cercopithecus callitrichus*), ♀. Presented by G. P. Kinahan, Esq.
1 Spoonbill (*Platalea leucorodia*). Presented by Capt. E. W. Burnett.
1 Kestrel (*Tinnunculus alaudarius*). Presented by Capt. E. W. Burnett.
21. 1 Ring-Ouzel (*Turdus torquatus*), ♀. Deposited.
2 Sacred Kingfishers (*Halcyon sancta*). Deposited.
1 Forsten's Lorikeet (*Trichoglossus forsteni*). Deposited.
23. 1 Westerman's Eclectus (*Eclectus westermani*), ♀. Deposited.
1 Corn-Crake (*Crex pratensis*). Presented by Collingwood Ingram, Esq.
1 Ring-hals Snake (*Sepedon hæmachates*). Presented by J. E. Matcham, Esq., C.M.Z.S.,
24. 1 Sooty Mangabey (*Cercocebus fuliginosus*), ♀. Presented by the Rev. A. Clutterbuck.
4 Common Squirrels (*Sciurus vulgaris*). Purchased.
25. 2 Red-footed Lemurs (*Lemur rufipes*), ♂ ♀. Deposited.
1 Puisa Ichneumon (*Bdeogale puisa*). Deposited.
1 Greater Vasa Parrot (*Coracopsis vasa*). Presented by Mr. C Hunt.
26. 1 Leopard (young) (*Felis pardus*), ♀. Presented by Capt. J. L. Stanistreet.
2 Black-tailed Godwits (*Limosa ægocephala*). Deposited.
10 Salt-water Terrapins (*Malaclemmys terrapin*). Deposited.

Oct. 30. 1 Shag (*Phalacrocorax graculus*). Presented by E. S. Montague, Esq.

31. 2 Glaucous Gulls (*Larus glaucus*). Presented by H. J. Pearson, Esq.
1 Herring-Gull (*Larus argentatus*). Presented by H. J. Pearson, Esq.
12 Golden Carp (*Carassius auratus*). Purchased.

Nov. 1. 4 Blanding's Terrapins (*Emys blandingi*). Deposited.
5 Prickly Trionyx (*Trionyx spinifer*). Deposited.

2. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Chas. Dallas, Esq.

3. 1 Vulpine Phalanger (*Trichosurus vulpecula*), ♂. Presented by D. Woosnam, Esq.

4. 2 Grand Eclectus (*Eclectus roratus*), 2♀. Deposited.
1 Mealy Amazon (*Chrysotus farinosa*). Deposited.
7 Cape Scorpions (*Opisthophthalmus capensis*). Presented by Dr. W. F. Purcell.

6. 1 Viverrine Phalanger (*Pseudochirus cooki*), ♂. Deposited.
1 Agile Wallaby (*Macropus agilis*), ♀. Deposited.

7. 2 Thigh-striped Wallabies (*Macropus thetidis*), 2♂. Deposited.
2 Cardinal Eclectus (*Eclectus cardinalis*), ♂ ♀. From Amboyna. Deposited.
1 Cardinal Eclectus (*Eclectus cardinalis*), ♂. From Buru. Deposited.
4 Mississippi Terrapins (*Malacoclemmys geographica*). Deposited.
3 Prickly Trionyx (*Trionyx spinifer*). Deposited.
4 Menobranchs (*Necturus maculatus*). Deposited.
1 Amphiuma (*Amphiuma means*). Deposited.
1 Spring-bok (*Gazella euchore*), ♂. Received in Exchange.

8. 1 Vervet Monkey (*Cercopithecus lalandii*), ♀. Deposited.
1 Brown Capuchin (*Cebus fatuellus*). Deposited.
3 Mute Swans (*Cygnus olor*). Deposited.

9. 1 Hog-Deer (*Cervus porcinus*). Bred in the Menagerie.
1 Black-backed Jackal (*Canis mesomelas*). Purchased.
2 Brazilian Caracaras (*Polyborus brasiliensis*). Purchased.
1 Anaconda (*Eunectes murinus*). Purchased.

10. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by W. J. Beard, Esq.
1 Rufous-necked Wallaby (*Macropus ruficollis*), ♂. Deposited.

11. 1 Sykes's Monkey (*Cercopithecus albigularis*), ♀. Presented by the Lord Alexander Thynne.

13. 1 White-tailed Gnu (*Connochætes gnu*), ♂. Presented by C. D. Rudd, Esq., F.Z.S.
1 Roi Rhe-bok (*Cervicapra fulvo-rufula*), ♂. Purchased.
1 Spring-bok (*Gazella euchore*), ♀. Deposited.
2 Schalow's Touracous (*Turacus schalowi*). From Benguela. Presented by W. L. Sclater, Esq., F.Z.S.
4 Cape Turtle-Doves (*Turtur capicola*). Presented by W. L. Sclater, Esq., F.Z.S.
1 Vulturine Eagle (*Aquila verreauxi*). Presented by the Rev. Dr. Kolbe.
1 Tawny Eagle (*Aquila nævioides*). Presented by Claude Scuthey, Esq.
2 Dusty Ichneumons (*Herpestes pulverulentus*). Presented by the Trustees of the South-African Museum.

Nov. 13. 1 Cape Crowned Crane (*Balearica regulorum*). Presented by the Trustees of the South-African Museum.
14. 2 Mandrills (*Cynocephalus mormon*), 2 ♂. Deposited.
2 White-collared Mangabeys (*Cercocebus collaris*), ♂ ♀. Deposited.
1 Lucan's Crested Eagle (*Lophotriorchis lucani*). Deposited.
1 White-tailed Ichneumon (*Herpestes albicauda*). From the Atbara River, Egyptian Soudan. Deposited.
1 Spotted Ichneumon (*Herpestes auro-punctatus*). From Busreh, Persian Gulf. Presented by B. T. Ffinch, Esq., F.Z.S.
1 Gannet (*Sula bassana*). Purchased.
15. 4 Lesser Pin-tailed Sand-Grouse (*Pterocles exustus*). Deposited.
1 Black-headed Partridge (*Caccabis melanocephala*). Deposited.
7 Cape Doves (*Œna capensis*). From Arabia. Deposited.
16. 1 Yellow-headed Conure (*Conurus jendaya*). Deposited.
17. 1 Brown Tree-Kangaroo (*Dendrolagus inustus*), ♀. Deposited.
1 Tantalus Monkey (*Cercopithecus tantalus*), ♂. Deposited.
18. 1 Diana Monkey (*Cercopithecus diana*), ♂. Presented by E. F. Martin, Esq.
20. 1 Indian Antelope (*Antilope cervicapra*), ♂. Deposited.
1 Persian Gazelle (*Gazella subgutturosa*), ♂. Presented by B. T. Ffinch, Esq., F.Z.S.
1 Chaplain Crow (*Corvus capellanus*). Presented by B. T. Ffinch, Esq., F.Z.S.
21. 2 Red-backed Buntings (*Emberiza rutila*). Purchased.
22. 2 Chipping Squirrels (*Tamias striatus*). Presented by C. M. Stewart, Esq.
2 Snake-Fishes (*Polypterus senegalus*). From the River Gambia. Presented by J. S. Budgett, Esq., F.Z.S. See P. Z. S. 1899, p. 985.
1 Sooty Phalanger (*Trichosurus fuliginosus*), ♂. Deposited.
1 Banded Parrakeet (*Palæornis fasciatus*), ♂. Deposited.
24. 1 Vervet Monkey (*Cercopithecus lalandii*), ♂. Presented by Mrs. A. Rousbey.
25. 1 Fennec Fox (*Canis cerdo*). Deposited.
27. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by J. A. Ewen, Esq., J.P.
28. 1 Brown Capuchin (*Cebus fatuellus*), ♀. Presented by Douglas Mason, Esq.
29 1 Rufous Rat-Kangaroo (*Æpyprymnus rufescens*), ♂. Deposited.
2 Ornamental Lorrikeets (*Trichoglossus ornatus*). Deposited.
1 Banded Parrakeet (*Palæornis fasciata*), ♂. Deposited.
2 Undulated Grass-Parrakeets (var.) (*Melopsittacus undulatus*). Deposited.
1 Lapwing (var.) (*Vanellus vulgaris*). Deposited.
2 Wrinkled Terrapins (*Chrysemys scripta rugosa*). Deposited.
4 Starred Tortoises (*Testudo elegans*). Deposited.
2 Emperor Boas (*Boa imperator*). Deposited.
30. 1 Common Badger (*Meles taxus*). Presented by G. E. Branson, Esq.

Dec. 1. 2 Golden Agoutis (*Dasyprocta agouti*). Presented by C. Bevan, Esq.
1 Common Trout (*Salmo fario*). Presented by Arthur Irving, Esq.
2. 4 Bewick's Swans (*Cygnus bewicki*). Deposited.

Dec. 2. 1 White-bellied Sea-Eagle (*Haliaëtus leucogaster*). Presented by Capt. Francis Mayor.
4. 2 Common Scoters (*Œdemia nigra*). Purchased.
1 Tufted Duck (*Fuligula cristata*), ♀. Purchased.
1 Blackish Tortoise (*Testudo nigrita*). Deposited.
1 Annulated Terrapin (*Nicoria annulata*). Deposited.
3 Blanding's Terrapins (*Emys blandingi*). Deposited.
1 Delalande's Gecko (*Tarentola delalandii*). Presented by Mr. J. Chappell.
5. 2 Brown's Parrakeets (*Platycercus browni*). Deposited.
1 Partridge (*Perdix cinerea*). Purchased.
6. 2 Hobbies (*Falco subbuteo*). Presented by J. H. Ingram, Esq.
7. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mr. F. G. Stenning.
1 Fieldfare (*Turdus pilaris*). Presented by Mr. Herbert Goodchild.
8. 1 Lesser White-nosed Monkey (*Cercopithecus petaurista*). Presented by R. Caton Woodville, Esq.
9. 1 Mozambique Monkey (*Cercopithecus pygerythrus*). Deposited.
1 Yellow-footed Squirrel (*Sciurus ludovicianus*). Purchased.
1 Bee-eater (*Merops apiaster*). Deposited.
12. 1 Grey Flying-Squirrel (*Sciuropterus fimbriatus*). Presented by Capt. S. A. Harriss, I.M.S. From Chitral.
13. 1 Brush-tailed Kangaroo (*Petrogale penicillata*), ♂. Born in the Menagerie.
4 Common Sheldrakes (*Tadorna cornuta*). Purchased.
2 White-fronted Geese (*Anser albifrons*). Purchased.
2 Crossed Snakes (*Psammophis crucifer*). Presented by J. E. Matcham, Esq., C.M.Z.S.
2 Rhomb-marked Snakes (*Trimerorhinus rhombeatus*). Presented by J. E. Matcham, Esq., C.M.Z.S.
1 Puff-Adder (*Bitis arietans*). Presented by J. E. Matcham, Esq., C.M.Z.S.
2 Cape Bucephalus (*Dispholidus typus*). Presented by J. E. Matcham, Esq., C.M.Z.S.
14. 1 Harnessed Antelope (*Tragelaphus scriptus*), ♀. Born in the Menagerie.
15. 1 Pheasant (*Phasianus colchicus*), ♂. Presented by the Hon. E. A. Stonor.
1 Common Rattlesnakes (*Crotalus durissus*). Deposited.
2 Horrid Rattlesnakes (*Crotalus horridus*). Deposited.
18. 2 White-throated Capuchins (*Cebus hypoleucus*). Presented by Miss A. E. Faux.
20. 3 Dwarf Chameleons (*Chamæleon pumilus*). Presented by Mr. A. Galeffi.
27. 1 Suricate (*Suricata tetradactyla*). Deposited.
2 Long-necked Chelodines (*Chelodina longicollis*). Deposited.
6 Pennsylvanian Terrapins (*Cinosternum pennsylvanicum*). Deposited.
3 Speckled Terrapins (*Clemmys guttata*). Deposited.
2 Black-headed Terrapins (*Damonia reevesi unicolor*). Deposited.
28. 1 Mozambique Monkey (*Cercopithecus pygerythrus*), ♂. Deposited.
30. 1 Black-backed Jackal (*Canis mesomelas*). Presented by J. E. Matcham, Esq., C.M.Z.S.

BRITISH 25 AP 1900 MUSEUM

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THE ZOOLOGICAL SOCIETY OF LONDON.

This Society was instituted in 1826, under the auspices of Sir Humphry Davy, Bart., Sir Stamford Raffles, and other eminent Savants, for the advancement of Zoology and Animal Physiology, and for the introduction of new and curious subjects of the Animal Kingdom, and was incorporated by Royal Charter in 1829.

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The Offices (3 Hanover Square, W.), where all communications should be addressed, are open from Ten till Five, except on Saturdays, when they close at Two o'clock P.M.

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Persons who wish to become Fellows of the Society are requested to communicate with the undersigned.

PHILIP LUTLEY SCLATER, M.A., PH.D., F.R.S.,
Secretary.

3 Hanover Square, London, W.,
June, 1899.

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OF THE

ZOOLOGICAL SOCIETY OF LONDON

FOR

SCIENTIFIC BUSINESS.

(AT 3 HANOVER SQUARE, W.)

Session 1898–1899.

1898.

TUESDAY, NOVEMBER 15 and 29 | TUESDAY, DECEMBER 13

1899.

TUESDAY, JANUARY 17	TUESDAY, APRIL .. 18
„ FEBRUARY 7 and 21	„ MAY .... 2 and 16
„ MARCH .. 7 „ 21	„ JUNE .... 6 „ 20

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[June, 1899.]

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